

- Abele, E., Braun, S., Schraml, P., 2015a. Holistic simulation environment for energy consumption prediction of machine tools. *Procedia CIRP* 29, 251–256. doi:10.1016/j.procir.2015.02.059
- Abele, E., Eisele, C., Schrems, S., 2012. Simulation of the energy consumption for machine tools for a specific production task, In: *Leveraging Technology for a Sustainable World.* Springer, Berlin, Heidelberg, p. 233–237. doi:https://doi.org/10.1007/978-3-642-29069-5_40
- Abele, E., Panten, N., Menz, B., 2015b. Data collection for energy monitoring purposes and energy control of production machines. *Procedia CIRP* 29, 299–304. doi:10.1016/j.procir.2015.01.035
- Abele, E., Sielaff, T., Schiffler, A., Rothenbücher, S., 2011. Analyzing Energy Consumption of Machine Tool Spindle Units and Identification of Potential for Improvements of Efficiency, In: *Glocalized Solutions for Sustainability in Manufacturing:* Springer-Verlag Berlin Heidelberg, p. 280–285. doi:10.1007/978-3-642-19692-8_49
- Ak, R., Helu, M.M., Rachuri, S., 2015. Ensemble neural network model for predicting the energy consumption of a milling machine, In: *Proceedings of the ASME Design Engineering Technical Conference.* p. 1–7.
- Albertelli, P., 2017. Energy saving opportunities in direct drive machine tool spindles. *J. Clean. Prod.* 165, 855–873. doi:10.1016/j.jclepro.2017.07.175
- Albertelli, P., Keshari, A., Matta, A., 2016. Energy oriented multi cutting parameter optimization in face milling. *J. Clean. Prod.* 137, 1602–1618. doi:10.1016/j.jclepro.2016.04.012
- Altıntaş, R.S., Kahya, M., Ünver, H.Ö., 2016. Modelling and optimization of energy consumption for feature based milling. *Int. J. Adv. Manuf. Technol.* 86, 3345–3363. doi:10.1007/s00170-016-8441-7
- An, L., 2003. Optimization of machining parameters in multi-pass turning and milling operations. PhD diss., Concordia University.
- Anderberg, S.E., Kara, S., Beno, T., 2010. Impact of energy efficiency on computer numerically controlled machining. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 224, 531–541. doi:10.1243/09544054JEM1712

References

- Aramcharoen, A., Mativenga, P.T., 2014. Critical factors in energy demand modelling for CNC milling and impact of toolpath strategy. *J. Clean. Prod.* 78, 63–74. doi:10.1016/j.jclepro.2014.04.065
- Arif, M., Stroud, I. A., Akten, O., 2013. A model to determine the optimal parameters for sustainable-energy machining in a multi-pass turning operation. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 228, 866–877. doi:10.1177/0954405413508945
- Arriaza, O.V., Kim, D.W., Lee, D.Y., Suhaimi, M.A., 2017. Trade-off analysis between machining time and energy consumption in impeller NC machining. *Robot. Comput. Integrat. Manuf.* 43, 164–170. doi:10.1016/j.rcim.2015.09.014
- Asrai, R.I., Newman, S.T., Nassehi, A., 2018. A mechanistic model of energy consumption in milling. *Int. J. Prod. Res.* 56, 642–659. doi:10.1080/00207543.2017.1404160
- Avram, O., Stroud, I., Xirouchakis, P., 2011. A multi-criteria decision method for sustainability assessment of the use phase of machine tool systems. *Int. J. Adv. Manuf. Technol.* 53, 811–828.
- Avram, O.I., Xirouchakis, P., 2011. Evaluating the use phase energy requirements of a machine tool system. *J. Clean. Prod.* 19, 699–711. doi:10.1016/j.jclepro.2010.10.010
- Bagaber, S.A., Yusoff, A.R., 2018a. Multi-responses optimization in dry turning of a stainless steel as a key factor in minimum energy. *Int. J. Adv. Manuf. Technol.* 96, 1109–1122. doi:10.1007/s00170-018-1668-8
- Bagaber, S.A., Yusoff, A.R., 2018b. Sustainable optimization of dry turning of stainless steel based on energy consumption and machining cost. *Procedia CIRP*. doi:10.1016/j.procir.2018.08.300
- Bagaber, S.A., Yusoff, A.R., 2017. Multi-objective optimization of cutting parameters to minimize power consumption in dry turning of stainless steel 316. *J. Clean. Prod.* 157, 30–46. doi:10.1016/j.jclepro.2017.03.231
- Balogun, V. A., Gu, H., Mativenga, P.T., 2015. Improving the integrity of specific cutting energy coefficients for energy demand modelling. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 229, 2109–2117. doi:10.1177/0954405414546145
- Balogun, V. A., Mativenga, P.T., 2014. Impact of un-deformed chip thickness on specific energy in mechanical machining processes. *J. Clean. Prod.* 69, 260–268. doi:10.1016/j.jclepro.2014.01.036

- Balogun, V.A., Aramcharoen, A., Mativenga, P.T., Chuan, S.K., 2013. Impact of machine tools on the direct energy and associated carbon emissions for a standardized NC toolpath, In: Re-Engineering Manufacturing for Sustainability. Springer, Singapore, p. 192–202. doi:https://doi.org/10.1007/978-981-4451-48-2_32
- Balogun, V.A., Mativenga, P.T., 2013. Modelling of direct energy requirements in mechanical machining processes. *J. Clean. Prod.* 41, 179–186. doi:[10.1016/j.jclepro.2012.10.015](https://doi.org/10.1016/j.jclepro.2012.10.015)
- Bayoumi, A.E., Hutton, D.V, 1994. On the Closed Form Mechanistic Modeling of Milling : Specific Cutting Energy , Torque , and Power. *J. Mater. Eng. Perform.* 3, 151–158.
- Behrendt, T., Zein, A., Min, S., 2012. Development of an energy consumption monitoring procedure for machine tools. *CIRP Ann. - Manuf. Technol.* 61, 43–46. doi:[10.1016/j.cirp.2012.03.103](https://doi.org/10.1016/j.cirp.2012.03.103)
- Bhanot, N., Rao, P.V., Deshmukh, S.G., 2016. An integrated sustainability assessment framework: a case of turning process. *Clean Technol. Environ. Policy* 18, 1475–1513. doi:[10.1007/s10098-016-1130-2](https://doi.org/10.1007/s10098-016-1130-2)
- Bharambe, G., Dabeer, P., Sapate, K.D., Sawant, S.M., 2015. Energy savings for sustainability of machining process, In: Proceedings of the ASME 2015 International Mechanical Engineering Congress and Exposition. p. 1–9.
- Bhinge, R., Park, J., Law, K.H., Dornfeld, D. A., Helu, M., Rachuri, S., 2016. Toward a Generalized Energy Prediction Model for Machine Tools. *J. Manuf. Sci. Eng.* 139(4), 041013. doi:[10.1115/1.4034933](https://doi.org/10.1115/1.4034933)
- Bhushan, R.K., 2013. Optimization of cutting parameters for minimizing power consumption and maximizing tool life during machining of Al alloy SiC particle composites. *J. Clean. Prod.* 39, 242–254. doi:[10.1016/j.jclepro.2012.08.008](https://doi.org/10.1016/j.jclepro.2012.08.008)
- Bilga, P.S., Singh, S., Kumar, R., 2016. Optimization of energy consumption response parameters for turning operation using Taguchi method. *J. Clean. Prod.* 137, 1406–1417. doi:[10.1016/j.jclepro.2016.07.220](https://doi.org/10.1016/j.jclepro.2016.07.220).This
- Borgia, S., Albertelli, P., Bianchi, G., 2017. A simulation approach for predicting energy use during general milling operations. *Int. J. Adv. Manuf. Technol.* 90, 3187–3201. doi:[10.1007/s00170-016-9654-5](https://doi.org/10.1007/s00170-016-9654-5)

References

- Borgia, S., Pellegrinelli, S., Bianchi, G., Leonesio, M., 2014. A reduced model for energy consumption analysis in milling. *Procedia CIRP* 17, 529–534. doi:10.1016/j.procir.2014.01.105
- Brander, M., Sood, A., Wylie, C., Haughton, A., Lovell, J., 2011. Electricity-specific emission factors for grid electricity. *Econometrica* 1–22. Edinburgh, United Kingdom, doi:10.1021/es0400537
- Braun, S., Heisel, U., 2012. Simulation and prediction of process-oriented energy consumption of machine tools, In: *Leveraging Technology for a Sustainable World*. Springer, Berlin, Heidelberg, p. 245–250. doi:https://doi.org/10.1007/978-3-642-29069-5_42
- Brecher, C., Bäumler, S., Jasper, D., Triebs, J., 2012. Energy efficiency cooling systems for machine tools. In: *Leveraging Technology for a Sustainable World*. Springer, Berlin, Heidelberg, p. 239-244.
- Brecher, C., Jasper, D., Fey, M., 2017. Analysis of new, energy-efficient hydraulic unit for machine tools. *Int. J. Precis. Eng. Manuf. - Green Technol.* 4 (1), 5–11. doi:10.1007/s40684-017-0001-6
- Brecher, C., Triebs, J., Jasper, D., 2013. Energy efficient solutions for hydraulic units of machine tools, In: *Re-engineering Manufacturing for Sustainability*, Singapore. p. 191–196.
- Cai, W., Liu, F., Dinolov, O., Xie, J., Liu, P., Tuo, J., 2018. Energy benchmarking rules in machining systems. *Energy* 142, 258–263. doi:10.1016/j.energy.2017.10.030
- Cai, W., Liu, F., Xie, J., Liu, P., Tuo, J., 2017a. A tool for assessing the energy demand and efficiency of machining systems: Energy benchmarking. *Energy* 138, 332–347. doi:10.1016/j.energy.2017.07.039
- Cai, W., Liu, F., Zhang, H., Liu, P., Tuo, J., 2017b. Development of dynamic energy benchmark for mass production in machining systems for energy management and energy-efficiency improvement. *Appl. Energy* 202, 715–725. doi:10.1016/j.apenergy.2017.05.180
- Cai, Y., Shao, H., 2017. Energy efficiency state identification in milling processing based on improved HMM, In: *Proceedings of the ASME 2017 12th International Manufacturing Science and Engineering Conference*. p. 1–11.

- Cai, Y., Shi, X., Shao, H., Wang, R., Liao, S., 2018a. Energy efficiency state identification in milling processes based on information reasoning and Hidden Markov Model. *J. Clean. Prod.* 193, 397–413. doi:10.1016/j.jclepro.2018.04.265
- Cai, Y., Shi, X., Shao, H., Wang, R., Liao, S., 2018b. Energy efficiency state identification in milling processes based on information reasoning and Hidden Markov Model. *J. Clean. Prod.* 193, 397–413. doi:10.1016/j.jclepro.2018.04.265
- Cai, Y., Yuan, J., Shao, H., Liao, S., 2018c. Energy Efficiency State Mechanism and Identification in Milling Processes. *Procedia CIRP* 72, 1487–1492. doi:10.1016/j.procir.2018.03.115
- Calvanese, M.L., Albertelli, P., Matta, A., Taisch, M., 2013. Analysis of energy consumption in CNC machining centers and determination of optimal cutting conditions. In: Re-engineering Manufacturing for Sustainability, Singapore, p. 227-232.
- Campatelli, G., Lorenzini, L., Scippa, A., Gianni, C., Lorenzo, L., Antonio, S., 2014. Optimization of process parameters using a Response Surface Method for minimizing power consumption in the milling of carbon steel. *J. Clean. Prod.* 66, 309–316. doi:10.1016/j.jclepro.2013.10.025
- Campatelli, G., Scippa, A., Lorenzini, L., Sato, R., 2015. Optimal workpiece orientation to reduce the energy consumption of a milling process. *Int. J. Precis. Eng. Manuf. - Green Technol.* 2, 5-13. doi:10.1007/s40684-015-0001-3
- Camposeco-Negrete, C., 2015. Optimization of cutting parameters using Response Surface Method for minimizing energy consumption and maximizing cutting quality in turning of AISI 6061 T6 aluminum. *J. Clean. Prod.* 91, 109–117. doi:10.1016/j.jclepro.2014.12.017
- Camposeco-Negrete, C., 2013. Optimization of cutting parameters for minimizing energy consumption in turning of AISI 6061 T6 using Taguchi methodology and ANOVA. *J. Clean. Prod.* 53, 195–203. doi:10.1016/j.jclepro.2013.03.049
- Camposeco-Negrete, C., Calderón-Nájera, J. de D., 2019. Sustainable machining as a mean of reducing the environmental impacts related to the energy consumption of the machine tool: a case study of AISI 1045 steel machining. *Int. J. Adv. Manuf. Technol.* 102, 27–41. doi:10.1007/s00170-018-3178-0

References

- Camposeco-Negrete, C., Calderón-Nájera, J., Miranda-valenzuela, J., 2013. Optimization of cutting parameters in turning of AISI 1018 steel with constant material removal rate using robust design for minimizing cutting power, In: Proceedings of the ASME 2013 International Mechanical Engineering Congress and Exposition. p. 1–5.
- Camposeco-Negrete, C., De Dios Calderón Nájera, J., Miranda-Valenzuela, J.C., 2016. Optimization of cutting parameters to minimize energy consumption during turning of AISI 1018 steel at constant material removal rate using robust design. *Int. J. Adv. Manuf. Technol.* 83, 1341–1347. doi:10.1007/s00170-015-7679-9
- Cao, H., Li, H., Cheng, H., Luo, Y., Yin, R., Chen, Y., 2012. A carbon efficiency approach for life-cycle carbon emission characteristics of machine tools. *J. Clean. Prod.* 37, 19–28. doi:10.1016/j.jclepro.2012.06.004
- Chen, X., Li, C., Jin, Y., Li, L., 2018. Optimization of cutting parameters with a sustainable consideration of electrical energy and embodied energy of materials. *Int. J. Adv. Manuf. Technol.* 96, 775–788. doi:10.1007/s00170-018-1647-0
- Chetan, Ghosh, S., Rao, P. V., 2018. Specific cutting energy modeling for turning nickel-based Nimonic 90 alloy under MQL condition. *Int. J. Mech. Sci.* 146-147, 25–38. doi:10.1016/j.ijmecsci.2018.07.033
- CIBSE, 2006. Degree-days: theory and application - TM41. Chartered Institution of Building Services Engineers, London.
- Cui, X., Guo, J., 2018. Identification of the optimum cutting parameters in intermittent hard turning with specific cutting energy, damage equivalent stress, and surface roughness considered. *Int. J. Adv. Manuf. Technol.* 96, 4281–4293. doi:10.1007/s00170-018-1885-1
- Dahmus, J.B., Gutowski, T.G., 2004. An Environmental Analysis of Machining, in: ASME International Mechanical Engineering Congress and RD&D Expo. p. 1–10.
- De Araujo, J.B., de Oliveira, J.F.G., 2012. Evaluation of two competing machining processes based on sustainability indicators, In: Leveraging Technology for a Sustainable World. Springer, p. 317–322. doi:10.1007/978-3-642-29069-5_54
- De Carvalho, H.M.B., De Oliveira Gomes, J., Schmidt, M.A., Brandão, V.L.C., 2015. Vibration analysis and energy efficiency in interrupted face milling Processes. *Procedia CIRP* 29, 245–250. doi:10.1016/j.procir.2015.02.165

- Denkena, B., Helmecke, P., Hülsemeyer, L., 2015. Energy efficient machining of Ti-6Al-4V. *CIRP Ann. - Manuf. Technol.* 64, 61–64. doi:10.1016/j.cirp.2015.04.056
- Diaz, N., Helu, M., Jayanathan, S., Chen, Y., Horvath, A., Dornfeld, D., 2010. Environmental analysis of milling machine tool use in various manufacturing environments. In: Proceedings of the 2010 IEEE International Symposium on Sustainable Systems and Technology, p. 1-6. IEEE, 2010. doi:10.1109/ISSST.2010.5507763
- Diaz, N., Ninomiya, K., Noble, J., Dornfeld, D., 2012. Environmental impact characterization of milling and implications for potential energy savings in industry. *Procedia CIRP* 1, 518–523. doi:10.1016/j.procir.2012.04.092
- Diaz, N., Redelsheimer, E., Dornfeld, D., 2011. Energy consumption characterization and reduction strategies for milling machine tool use, In: Glocalized Solutions for Sustainability in Manufacturing. Springer-Verlag Berlin Heidelberg, p. 263–267. doi:10.1007/978-3-642-19692-8_46
- Draganescu, F., Gheorghe, M., Doicin, C. V., 2003. Models of machine tool efficiency and specific consumed energy. *J. Mater. Process. Technol.* 141 (1), 9–15. doi:10.1016/S0924-0136(02)00930-5
- Duflou, J.R., Sutherland, J.W., Dornfeld, D., Herrmann, C., Jeswiet, J., Kara, S., Hauschild, M., Kellens, K., 2012. Towards energy and resource efficient manufacturing: A processes and systems approach. *CIRP Ann. - Manuf. Technol.* 61, 587–609. doi:10.1016/j.cirp.2012.05.002
- Dureja, J.S., Gupta, V.K., Sharma, V.S., Dogra, M., 2010. Design optimisation of flank wear and surface roughness for CBN-TiN tools during dry hard turning of hot work die steel. *Int. J. Mach. Mach. Mater.* 7, 129–147.
- Eberspächer, P., Lechler, A., Verl, A., 2016. Control-integrated consumption graph-based optimisation method for energy reduction of machine tools with automated parameter optimisation. *Int. J. Comput. Integr. Manuf.* 29 (12), 1307-1316. doi:10.1080/0951192X.2015.1031703
- Eberspächer, P., Schraml, P., Schlechtendahl, J., Verl, A., Abele, E., 2014. A model- and signal-based power consumption monitoring concept for energetic optimization of machine tools. *Procedia CIRP* 15, 44–49. doi:10.1016/j.procir.2014.06.020

References

- Eberspächer, P., Verl, A., 2013. Realizing energy reduction of machine tools through a control-integrated consumption graph-based optimization method. *Procedia CIRP* 7, 640–645. doi:10.1016/j.procir.2013.06.046
- Ecodesign Directive, 2008. Progress Report on the Sustainable Development Strategy 2007: Communication From the Commission To the Council and The European Parliament. Office for Official Publications of the European Communities
- Edem, I.F., Balogun, V. A., Mativenga, P.T., 2017. An investigation on the impact of toolpath strategies and machine tool axes configurations on electrical energy demand in mechanical machining. *Int. J. Adv. Manuf. Technol.* 92, 2503–2509. doi:10.1007/s00170-017-0342-x
- Edem, I.F., Mativenga, P.T., 2017a. Energy Demand Reduction in Milling Based on Component and Toolpath Orientations. *Procedia Manuf.* 7, 253–261. doi:10.1016/j.promfg.2016.12.060
- Edem, I.F., Mativenga, P.T., 2017b. Modelling of energy demand from computer numerical control (CNC) toolpaths. *J. Clean. Prod.* 157, 310–321. doi:10.1016/j.jclepro.2017.04.096
- Edem, I.F., Mativenga, P.T., 2016. Impact of feed axis on electrical energy demand in mechanical machining processes. *J. Clean. Prod.* 137, 230–240. doi:10.1016/j.jclepro.2016.07.095
- EIA, 2017. International Energy Outlook 2017, U.S. Energy Information Administration. Int. Energy Outlook, vol. IEO2017 2017 (2017): 143. Available at: [www.eia.gov/forecasts/ieo/pdf/0484\(2016\).pdf](http://www.eia.gov/forecasts/ieo/pdf/0484(2016).pdf) (last accessed on 15 October 2018).
- EIA, 2016. EIA Beta - Country Analysis Brief: India. U.S. Energy Information Administration. Available at: <https://www.eia.gov/beta/international/analysis.php?iso=IND> (last accessed on 15 October 2018).
- Eisele, C., Schrems, S., Abele, E., 2011. Energy-efficient machine tools through simulation in the design proces., In: Glocalized Solutions for Sustainability in Manufacturing. Springer, Berlin, Heidelberg, p. 258–262. doi: 10.1007/978-3-642-19692-8_45

- Enerdata, 2012. India's Black Tuesday - July 31st 2012. Available at: <https://www.enerdata.net/publications/executive-briefing/india-s-black-tuesday-july-31st-2012.html> (last accessed on 15 October 2018)
- EPA, 2011. Sustainable Manufacturing United States Environmental Protection Agency Available at: <https://www.epa.gov/sustainability/sustainable-manufacturing> (last accessed on 5 December 2018)
- ET Bureau, 2018. India to achieve climate goals before schedule: Environment Minister Harsh Vardhan. The Economics Times, Available at: <https://economictimes.indiatimes.com> (last accessed on 18 January 2019)
- Fang, F., Cheng, K., Ding, H., Chen, S., Zhao, L., 2016. Sustainable design and analysis of cnc machine tools: Sustainable design index based approach and its application perspectives. in ASME 2016 11th International Manufacturing Science and Engineering Conference. American Society of Mechanical Engineers Digital Collection, 3, 1–10. doi:10.1115/MSEC20168730
- Faulkner, W., Badurdeen, F., 2014. Sustainable Value Stream Mapping (Sus-VSM): Methodology to visualize and assess manufacturing sustainability performance. J. Clean. Prod. 85, 8–18. doi:10.1016/j.jclepro.2014.05.042
- Fratila, D., 2013. Sustainable manufacturing through environmentally-friendly machining, In: Green Manufacturing Processes and Systems. Springer, p. 1–21.
- Frigerio, N., Matta, A., Ferrero, L., Rusinà, F., 2013. Modeling energy states in machine tools: An automata based approach, In: Re-Engineering Manufacturing for Sustainability. Springer, Singapore, p. 203–208. doi:https://doi.org/10.1007/978-981-4451-48-2_33
- Fu, T., Zhao, J., Liu, W., 2012. Multi-objective optimization of cutting parameters in high-speed milling based on grey relational analysis coupled with principal component analysis. Front. Mech. Eng. 7, 445–452. doi:10.1007/s11465-012-0338-z
- Fujishima, M., Mori, M., Oda, Y., 2014. Energy-efficient manufacturing on machine tools by machining process improvement. Prod. Eng. 8 (1-2), 217–224. doi:10.1007/s11740-013-0492-0
- Gaitonde, V.N., Karnik, S.R., Davim, J.P., 2012. Optimal mql and cutting conditions determination for desired surface roughness in turning of brass using genetic algorithms. Mach. Sci. Technol. 16, 304–320. doi:10.1080/10910344.2012.673976

References

- Garg, A., Lam, J.S.L., Gao, L., 2015. Energy conservation in manufacturing operations: Modelling the milling process by a new complexity-based evolutionary approach. *J. Clean. Prod.* 108, 34–45. doi:10.1016/j.jclepro.2015.06.043
- Gianni, C., Antonio, S., Lorenzo, L., Ryuta, S., Campatelli, G., Scippa, A., Lorenzini, L., Sato, R., 2015. Optimal workpiece orientation to reduce the energy consumption of a milling process. *Int. J. Precis. Eng. Manuf. Green Technol.* 2, 5–13. doi:10.1007/s40684-015-0001-3
- Goedkoop, M., Heijungs, R., Huijbregts, M., Schryver, A. De, Struijs, J., Zelm, R. Van, 2009. ReCiPe 2008 - A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level, Ministry of Housing, Spatial planning and environment (VROM), 1, 1-126. doi:10.029/2003JD004283
- Gontarz, A., Schudeleit, T., Wegener, K., 2015. Framework of a machine tool configurator for energy efficiency. *Procedia CIRP* 26, 706–711. doi:10.1016/j.procir.2014.07.185
- Götze, U., Koriath, H.J., Kolesnikov, A., Lindner, R., Paetzold, J., 2012. Integrated methodology for the evaluation of the energy and cost-effectiveness of machine tools. *CIRP J. Manuf. Sci. Technol.* 5, 151–163. doi:10.1016/j.cirpj.2012.04.001
- Guo, Y., Duflou, J.R., Qian, J., Tang, H., Lauwers, B., 2015. An operation-mode based simulation approach to enhance the energy conservation of machine tools. *J. Clean. Prod.* 101, 348–359. doi:10.1016/j.jclepro.2015.03.097
- Guo, Y., Loenders, J., Duflou, J., Lauwers, B., 2012. Optimization of energy consumption and surface quality in finish turning. *Procedia CIRP* 1, 512–517. doi:10.1016/j.procir.2012.04.091
- Gutowski, T., 2007. The carbon and energy intensity of manufacturing. In 40th Seminar of CIRP, Keynote Address, Liverpool University, Liverpool, UK. Available at: <http://web.mit.edu/ebm/www/Publications/Carbon%20Intensity%20of%20Manufacturing.pdf>.
- Gutowski, T., Dahmus, J., Thiriez, A., 2006. Electrical Energy Requirements for Manufacturing Processes, In: 13th CIRP International Conference of Life Cycle Engineering, Lueven, p. 623-638.
- Gutowski, T., Murphy, C., Allen, D., Bauer, D., Bras, B., Piwonka, T., Sheng, P., Sutherland, J., Thurston, D., Wolff, E., 2005. Environmentally benign manufacturing:

- Observations from Japan, Europe and the United States. *J. Clean. Prod.* 13, 1–17. doi:10.1016/j.jclepro.2003.10.004
- Haapala, K.R., Zhao, F., Camelio, J., Sutherland, J.W., Skerlos, S.J., Dornfeld, D., Jawahir, I.S., Zhang, H.C., Clarens, A.F., 2011. A Review of Engineering Research in Sustainable Manufacturing. *J MANUF SCI E-T ASME* 135 (4), 599–619. doi:10.1115/MSEC2011-50300
- Hacksteiner, M., Duer, F., Ayatollahi, I., Bleicher, F., 2017. Automatic Assessment of Machine Tool Energy Efficiency and Productivity. *Procedia CIRP* 62, 317–322. doi:10.1016/j.procir.2016.06.034
- Hanafi, I., Khamlichi, A., Cabrera, F.M., Almansa, E., Jabbouri, A., 2012. Optimization of cutting conditions for sustainable machining of PEEK-CF30 using TiN tools. *J. Clean. Prod.* 33, 1–9. doi:10.1016/j.jclepro.2012.05.005
- Hart, C., 1998. Doing a literature review – releasing the social science research imagination, London: SAGE Publications.
- He, K., Tang, R., Jin, M., 2017. Pareto fronts of machining parameters for trade-off among energy consumption, cutting force and processing time. *Int. J. Prod. Econ.* 185, 113–127. doi:10.1016/j.ijpe.2016.12.012
- He, Y., Liu, B., Zhang, X., Gao, H., Liu, X., 2012. A modeling method of task-oriented energy consumption for machining manufacturing system. *J. Clean. Prod.* 23, 167–174. doi:10.1016/j.jclepro.2011.10.033
- He, Y., Liu, F., Wu, T., Zhong, F.P.P., Peng, B., 2011. Analysis and estimation of energy consumption for numerical control machining. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 226, 255–266. doi:10.1177/0954405411417673
- Hegab, H.A., Darras, B., Kishawy, H.A., 2018. Towards sustainability assessment of machining processes. *J. Clean. Prod.* 170, 694–703. doi:10.1016/j.jclepro.2017.09.197
- Heilala, J., Vatanen, S., Tonteri, H., Montonen, J., Lind, S., Johansson, B., Stahre, J., 2008. Simulation-based sustainable manufacturing system design, In: Proceedings of the 40th Conference on Winter Simulation. Winter Simulation Conference, p. 1922–1930.

References

- Hernández, E.B., Beno, T., Fredriksson, C., 2017. Energy and Cost Estimation of a Feature-based Machining Operation on HRSA. *Procedia CIRP* 61, 511–516. doi:10.1016/j.procir.2016.11.141
- Herrmann, C., Kara, S., Thiede, S., Luger, T., 2010. Efficiency in Manufacturing – Perspectives from Australia and Europe. In: 17th CIRP International Conference of Life Cycle Engineering, Hefei, China, p.19–21.
- Herrmann, C., Suh, S.H., Bogdanski, G., Zein, A., Cha, J.M., Um, J., Jeong, S., 2011. Context-Aware Analysis Approach to Enhance Industrial Smart Metering, In: Glocalized Solutions for Sustainability in Manufacturing. Springer, Berlin, Heidelberg, p. 323–328. doi:https://doi.org/10.1007/978-3-642-19692-8_56
- Hu, L., Liu, Y., Lohse, N., Tang, R., Lv, J., Peng, C., Evans, S., 2017a. Sequencing the features to minimise the non-cutting energy consumption in machining considering the change of spindle rotation speed. *Energy* 139, 935–946. doi:10.1016/j.energy.2017.08.032
- Hu, L., Liu, Y., Peng, C., Tang, W., Tang, R., Tiwari, A., 2018a. Minimising the energy consumption of tool change and tool path of machining by sequencing the features. *Energy* 147, 390–402. doi:10.1016/j.energy.2018.01.046
- Hu, L., Peng, C., Evans, S., Peng, T., Liu, Y., Tang, R., Tiwari, A., 2017b. Minimising the machining energy consumption of a machine tool by sequencing the features of a part. *Energy* 121, 292–305. doi:10.1016/j.energy.2017.01.039
- Hu, L., Tang, R., He, K., Jia, S., 2015. Estimating machining-related energy consumption of parts at the design phase based on feature technology. *Int. J. Prod. Res.* 53, 7016–7033. doi:10.1080/00207543.2014.944281
- Hu, L., Tang, R., Liu, Y., Cao, Y., Tiwari, A., 2018b. Optimising the machining time, deviation and energy consumption through a multi-objective feature sequencing approach. *Energy Convers. Manag.* 160, 126–140. doi:10.1016/j.enconman.2018.01.005
- Hu, S., Liu, F., He, Y., Hu, T., 2012. An on-line approach for energy efficiency monitoring of machine tools. *J. Clean. Prod.* 27, 133–140. doi:10.1016/j.jclepro.2012.01.013
- Hu, S., Liu, F., He, Y., Peng, B., 2010. Characteristics of Additional Load Losses of Spindle System of Machine Tools. *J. Adv. Mech. Des. Syst. Manuf.* 4, 1221–1233. doi:10.1299/jamds.4.1221

- Huang, J., Liu, F., Xie, J., 2016. A method for determining the energy consumption of machine tools in the spindle start-up process before machining. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 230, 1639–1649. doi:10.1177/0954405415600679
- Huijbregts, M.A.J., Steinmann, Z.J., Elshout, P.M.F., Stam, G., Verones, F., Vieira, M.D.M., Zijp, M., van Zelm, R., 2016. ReCiPe 2016: A harmonized life cycle impact assessment method at midpoint and endpoint level - Report 1 : characterization. Bilthoven.
- IEA, 2007. Tracking Industrial Energy Efficiency and CO₂ Emissions. Available at: https://www.iea.org/publications/freepublications/publication/tracking_emissions.pdf (last accessed on 10 January 2019).
- IFU Hamburg, 2015. Umberto NXT Universal. Sustainability and Productivity - One Software for Both Goals.<http://www.umberto.de/en/versions/umberto-nxt-universal/>. (Accessed 17 September 2018).
- International Monetary Fund, 2018. World Economic Outlook Database. World Econ Finance Survey.
- IPCC, 2008. IPCC Guidelines for National Greenhouse Gas Inventories. Natl. Greenh. gas Invent. Program.
- Iqbal, A., Zhang, H.C., Kong, L.L., Hussain, G., 2015. A rule-based system for trade-off among energy consumption, tool life, and productivity in machining process. *J. Intell. Manuf.* 26, 1217–1232. doi:10.1007/s10845-013-0851-x
- ISO (International Organization for Standardization), 2016. ISO 14955-2. Machine Tools - Environmental Evaluation of Machine tools - Part 2: Methods for Measuring Energy Supplied to Machine Tools and Machine Tool Components.
- ISO (International Organization for Standardization), 2014. ISO 14955-1. Machine Tools - Environmental Evaluation of Machine Tools - Part 1: Design Methodology for Energy-efficient Machine Tools.
- ISO 14040, 1997. Environmental management—life cycle assessment—principles and framework.
- ISO 14041, 1998. Environmental management—life cycle assessment—goal and scope definition and inventory analysis.
- ISO 14042, 2000. Environmental management—life cycle assessment—life cycle impact assessment.

References

- ISO 14043, 2000. Environmental management—life cycle assessment—life cycle interpretation.
- Jang, D.Y., Jung, J., Seok, J., 2016. Modeling and parameter optimization for cutting energy reduction in MQL milling process. *Int. J. Precis. Eng. Manuf. - Green Technol.* 3, 5–12. doi:10.1007/s40684-016-0001-y
- Jawahir, I.S., Balaji, A.K., 2000. Predictive modeling and optimization of turning operations with complex grooved cutting tools for curled chip formation and chip breaking. *Mach. Sci. Technol.* 4, 399–443. doi:10.1080/10940340008945717
- Jawahir, I.S., Wanigarathne, P.C., Wang, X., 2005. Product design and manufacturing processes for sustainability. *Mech. Eng. Handb. Manuf. Manag.* 3, 414–443.
- Jeswiet, J., Kara, S., 2008. Carbon emissions and CESTM in manufacturing. *CIRP Ann. - Manuf. Technol.* 57, 17–20. doi:10.1016/j.cirp.2008.03.117
- Jia, S., Tang, R., Lv, J., 2016a. Machining activity extraction and energy attributes inheritance method to support intelligent energy estimation of machining process. *J. Intell. Manuf.* 27, 595–616. doi:10.1007/s10845-014-0894-7
- Jia, S., Tang, R., Lv, J., 2014. Therblig-based energy demand modeling methodology of machining process to support intelligent manufacturing. *J. Intell. Manuf.* 25, 913–931. doi:10.1007/s10845-012-0723-9
- Jia, S., Tang, R., Lv, J., Yuan, Q., Peng, T., 2017a. Energy consumption modeling of machining transient states based on finite state machine. *Int. J. Adv. Manuf. Technol.* 88, 2305–2320. doi:10.1007/s00170-016-8952-2
- Jia, S., Tang, R., Lv, J., Zhang, Z., Yuan, Q., 2016b. Energy modeling for variable material removal rate machining process: an end face turning case. *Int. J. Adv. Manuf. Technol.* 85, 2805–2818. doi:10.1007/s00170-015-8133-8
- Jia, S., Yuan, Q., Cai, W., Li, M., Li, Z., 2018. Energy modeling method of machine-operator system for sustainable machining. *Energy Convers. Manag.* 172, 265–276. doi:10.1016/j.enconman.2018.07.030
- Jia, S., Yuan, Q., Lv, J., Liu, Y., Ren, D., Zhang, Z., 2017b. Therblig-embedded value stream mapping method for lean energy machining. *Energy* 138, 1081–1098. doi:10.1016/j.energy.2017.07.120

- Josyula, S.K., Narala, S.K.R., 2018. Performance enhancement of cryogenic machining and its effect on tool wear during turning of Al-Ticpcomposites. *Mach. Sci. Technol.* 22, 225–248. doi:10.1080/10910344.2017.1337133
- Kant, G., Sangwan, K.S., 2015a. Predictive Modeling for Power Consumption in Machining Using Artificial Intelligence Techniques. *Procedia CIRP* 26, 403–407.
- Kant, G., Sangwan, K.S., 2015b. Predictive modelling for energy consumption in machining using artificial neural network. *Procedia CIRP* 37, 205–210. doi:10.1016/j.procir.2015.08.081
- Kant, G., Sangwan, K.S., 2014. Prediction and optimization of machining parameters for minimizing power consumption and surface roughness in machining. *J. Clean. Prod.* 83, 151–164. doi:10.1016/j.jclepro.2014.07.073
- Kapoor, S.G., DeVor, R.E., Zhu, R., Gajjela, R., Parakkal, G., Smithey, D., 1998. Development of mechanistic models for the prediction of machining performance: Model building methodology. *Mach. Sci. Technol.* 2, 213–238. doi:10.1080/10940349808945669
- Kara, S., Li, W., 2011. Unit process energy consumption models for material removal processes. *CIRP Ann. - Manuf. Technol.* 60, 37–40. doi:10.1016/j.cirp.2011.03.018
- Karpov, A. V., 2015. Determining the effective conditions for machining fabrication procedures based on the cutting process energy patterns. *Procedia Eng.* 129, 116–120. doi:10.1016/j.proeng.2015.12.018
- Kellens, K., Dewulf, W., Overcash, M., Hauschild, M. Z., Duflou, J. R., 2012. Methodology for systematic analysis and improvement of manufacturing unit process life-cycle inventory (UPLCI)—CO2PE! initiative (cooperative effort on process emissions in manufacturing). Part 1: Methodology description. *Int. J. Life Cycle Assess.* 17(1), 69–78. doi: 10.1007/s11367-011-0340-4
- Kianinejad, K., Uhlmann, E., Peukert, B., 2015. Investigation into energy efficiency of outdated cutting machine tools and identification of improvement potentials to promote sustainability. *Procedia CIRP* 26, 533–538. doi:10.1016/j.procir.2014.07.083
- Kim, D.B., Leong, S., Chen, C.-S., 2012. An Overview of Sustainability Indicators and Metrics for Discrete Part Manufacturing, In: Proceedings of the ASME 2012 International Design Engineering Technical Conferences & Computers and

References

- Information in Engineering Conference. p. 1173-1181. American Society of Mechanical Engineers.
- Klöpffer, W., 1997. Life cycle assessment: From the beginning to the current state. *Environ. Sci. Pollut. Res. Int.* 4, 223–228. doi:10.1007/BF02986351
- Kolar, M., Vyroubal, J., Smolik, J., 2016. Analytical approach to establishment of predictive models of power consumption of machine tools' auxiliary units. *J. Clean. Prod.* 137, 361–369. doi:10.1016/j.jclepro.2016.07.092
- Kreitlein, S., Scholz, M., Franke, J., 2017. The Automated Evaluation of the Energy Efficiency for Machining Applications based on the Least Energy Demand. *Procedia CIRP* 61, 404–409. doi:10.1016/j.procir.2016.11.167
- Kroll, L., Blau, P., Wabner, M., Friess, U., Eulitz, J., Klärner, M., 2011. Lightweight components for energy-efficient machine tools. *CIRP J. Manuf. Sci. Technol.* 4, 148–160. doi:10.1016/j.cirpj.2011.04.002
- Kumar, R., Bilga, P.S., Singh, S., 2017. Multi objective optimization using different methods of assigning weights to energy consumption responses, surface roughness and material removal rate during rough turning operation. *J. Clean. Prod.* 164, 45–57. doi:10.1016/j.jclepro.2017.06.077
- Lajevardi, B., Haapala, K.R., Junker, J.F., 2015. Real-time monitoring and evaluation of energy efficiency and thermal management of data centers. *J. Manuf. Syst.* 37, 511–516. doi:10.1016/j.jmsy.2014.06.008
- Lanz, M., Mani, M., Leong, S., Lyons, K., Ranta, A., Ikkala, K., Bengtsson, N., 2010. Impact of energy measurements in machining operations. In: ASME 2010 International design engineering technical conferences and computers and information in engineering conference. American Society of Mechanical Engineers Digital Collection, p. 867–873.
- Lee, J.Y., Shin, Y.J., Kim, M.S., Kim, E.S., Yoon, H.S., Kim, S.Y., Yoon, Y.C., Ahn, S.H., Min, S., 2015. A Simplified Machine-Tool Power-Consumption Measurement Procedure and Methodology for Estimating Total Energy Consumption. *J. Manuf. Sci. Eng.* 138, 051004. doi:10.1115/1.4031713
- Lee, W., Kim, S.H., Park, J., Min, B.K., 2017. Simulation-based machining condition optimization for machine tool energy consumption reduction. *J. Clean. Prod.* 150, 352–360. doi:10.1016/j.jclepro.2017.02.178

- Lenz, J., Kotschenreuther, J., Westkaemper, E., 2017. Energy Efficiency in Machine Tool Operation by Online Energy Monitoring Capturing and Analysis. *Procedia CIRP* 61, 365–369. doi:10.1016/j.procir.2016.11.202
- Li, C., Chen, X., Tang, Y., Li, L., 2017. Selection of optimum parameters in multi-pass face milling for maximum energy efficiency and minimum production cost. *J. Clean. Prod.* 140, 1805–1818. doi:10.1016/j.jclepro.2016.07.086
- Li, C., Li, L., Tang, Y., Zhu, Y., Li, L., 2016a. A comprehensive approach to parameters optimization of energy-aware CNC milling. *J. Intell. Manuf.* 30 (1), 123-138. doi:10.1007/s10845-016-1233-y
- Li, C., Tang, Y., Cui, L., Li, P., 2015. A quantitative approach to analyze carbon emissions of CNC-based machining systems. *J. Intell. Manuf.* 26, 911–922. doi:10.1007/s10845-013-0812-4
- Li, C., Tang, Y., Cui, L., Yi, Q., 2013. Quantitative analysis of carbon emissions of CNC-based machining systems. In: 2013 10th IEEE International Conference on Networking, Sensing and Control (ICNSC), p. 869-874. IEEE.
- Li, C., Xiao, Q., Tang, Y., Li, L., 2016b. A method integrating Taguchi, RSM and MOPSO to CNC machining parameters optimization for energy saving. *J. Clean. Prod.* doi:10.1016/j.jclepro.2016.06.097.
- Li, J.G.G., Lu, Y., Zhao, H., Li, P., Yao, Y.-X.X., 2014. Optimization of cutting parameters for energy saving. *Int. J. Adv. Manuf. Technol.* 70, 117–124. doi:10.1007/s00170-013-5227-z
- Li, L., Deng, X., Zhao, J., Zhao, F., Sutherland, J.W., 2018. Multi-objective optimization of tool path considering efficiency, energy-saving and carbon-emission for free-form surface milling. *J. Clean. Prod.* 172, 3311–3322. doi:10.1016/j.jclepro.2017.07.219
- Li, L., Li, C., Tang, Y., Yi, Q., 2017. Influence factors and operational strategies for energy efficiency improvement of CNC machining. *J. Clean. Prod.* 161, 220–238. doi:10.1016/j.jclepro.2017.05.084
- Li, L., Yan, J., Xing, Z., 2013. Energy requirements evaluation of milling machines based on thermal equilibrium and empirical modelling. *J. Clean. Prod.* 52, 113–121. doi:10.1016/j.jclepro.2013.02.039

References

- Li, T., Yuan, C., 2013. Numerical Modeling of Specific Energy Consumption in Machining Process, In: Proceedings of the ASME 2013 International Manufacturing Science and Engineering Conference. Wisconsin, USA, p. 1–6.
- Li, W., 2015. Efficiency of Manufacturing Processes: Energy and Ecological Perspectives. Springer International Publishing.
- Li, W., Kara, S., 2011. An empirical model for predicting energy consumption of manufacturing processes: a case of turning process. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 225, 1636–1646. doi:10.1177/2041297511398541
- Li, W., Zein, A., Kara, S., Herrmann, C., 2011. An investigation into fixed energy consumption of machine tools, In: Glocalized Solutions for Sustainability in Manufacturing. Springer-Verlag Berlin Heidelberg. doi:10.1007/978-3-642-19692-8
- Li, X.X., Li, W.D., He, F.Z., 2018. A multi-granularity NC program optimization approach for energy efficient machining. *Adv. Eng. Softw.* 115, 75–86. doi:10.1016/j.advengsoft.2017.08.014
- Linke, B., Das, J., Lam, M., Ly, C., 2014. Sustainability indicators for finishing operations based on process performance and part quality. *Procedia CIRP* 14, 564–569. doi:10.1016/j.procir.2014.03.017
- Liu, D., Wang, W., Wang, L., 2017. Energy-Efficient Cutting Parameters Determination for NC Machining with Specified Machining Accuracy. *Procedia CIRP* 61, 523–528. doi:10.1016/j.procir.2016.11.215
- Liu, F., Xie, J., Liu, S., 2015. A method for predicting the energy consumption of the main driving system of a machine tool in a machining process. *J. Clean. Prod.* 105, 171–177. doi:10.1016/j.jclepro.2014.09.058
- Liu, N., Zhang, Y.F., Lu, W.F., 2015. A hybrid approach to energy consumption modelling based on cutting power: A milling case. *J. Clean. Prod.* 104, 264–272. doi:10.1016/j.jclepro.2015.05.049
- Liu, P., Liu, F., Qiu, H., 2017. A novel approach for acquiring the real-time energy efficiency of machine tools. *Energy* 121, 524–532. doi:10.1016/j.energy.2017.01.047
- Liu, P., Tuo, J., Liu, F., Li, C., Zhang, X., 2018. A novel method for energy efficiency evaluation to support efficient machine tool selection. *J. Clean. Prod.* 191, 57–66. doi:10.1016/j.jclepro.2018.04.204

- Liu, Q., Zhang, Y., Zhou, Y., 2017. Integrated optimization of cutting parameters and scheduling for reducing carbon emissions. *J. Clean. Prod.* 149, 886–895. doi:10.1016/j.jclepro.2017.01.054
- Liu, Z., Guo, Y., 2018. A hybrid approach to integrate machine learning and process mechanics for the prediction of specific cutting energy. *CIRP Ann.* 67, 57–60. doi:10.1016/j.cirp.2018.03.015
- Liu, Z.Y., Li, C., Fang, X.Y., Guo, Y.B., 2018a. Cumulative energy demand and environmental impact in sustainable machining of inconel superalloy. *J. Clean. Prod.* 181, 329–336. doi:10.1016/j.jclepro.2018.01.251
- Liu, Z.Y., Sealy, M.P., Li, W., Zhang, D., Fang, X.Y., Guo, Y.B., Liu, Z.Q., 2018b. Energy consumption characteristics in finish hard milling. *J. Manuf. Process.* 35, 500–507. doi:10.1016/j.jmapro.2018.08.036
- Liu, Z.Y., Sealy, M.P., Li, W., Zhang, D., Fang, X.Y., Guo, Y.B., Liu, Z.Q., 2015. Energy consumption characteristics in finish hard milling of tool steels. *Procedia Manuf.* 1, 477–486.
- Lu, C., Gao, L., Li, X., Chen, P., 2016. Energy-efficient multi-pass turning operation using multi-objective backtracking search algorithm. *J. Clean. Prod.* 137, 1516–1531. doi:10.1016/j.jclepro.2016.07.029
- Lu, H.S., Chang, C.K., Hwang, N.C., Chung, C.T., 2009. Grey relational analysis coupled with principal component analysis for optimization design of the cutting parameters in high-speed end milling. *J. Mater. Process. Technol.* 209, 3808–3817. doi:10.1016/j.jmatprotoc.2008.08.030
- Lu, T., Gupta, Jayal, A.D., Badurdeen, F., Feng, S.C., Dillon, O.W.J., Jawahir, I.S., 2011. A Framework of Product and Process Metrics for Sustainable Manufacturing, In: 8th Global Conference on Sustainable Manufacturing. Abu Dhabi, UAE, p. 331–336. doi:10.1007/978-3-642-20183-7
- Lu, T., Rotella, G., Feng, S.C., Badurdeen, F., Dillon, O.W., Rouch, K., Jawahir, I.S., 2012. Metrics-based sustainability assessment of a drilling process, In: Sustainable Manufacturing. Springer, p. 59–64.
- Luan, X., Zhang, S., Chen, J., Li, G., 2018a. Energy modelling and energy saving strategy analysis of a machine tool during non-cutting status. *Int. J. Prod. Res.* 7543, 1–17. doi:10.1080/00207543.2018.1436787

References

- Luan, X., Zhang, S., Li, J., Li, G., Chen, J., Mendis, G., 2018b. Comprehensive effects of tool paths on energy consumption, machining efficiency, and surface integrity in the milling of alloy cast Iron. *Int. J. Adv. Manuf. Technol.* 98, 1847–1860. doi:10.1007/s00170-018-2269-2
- Luan, X., Zhang, S., Li, J., Mendis, G., Zhao, F., Sutherland, J.W., 2018c. Trade-off analysis of tool wear, machining quality and energy efficiency of alloy cast iron milling process. *Procedia Manuf.* 26, 383–393. doi:10.1016/j.promfg.2018.07.046
- Lv, J., Peng, T., Tang, R., 2018. Energy modeling and a method for reducing energy loss due to cutting load during machining operations. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* doi:10.1177/0954405418769922
- Lv, J., Tang, R., Jia, S., 2014. Therblig-based energy supply modeling of computer numerical control machine tools. *J. Clean. Prod.* 65, 168–177.
- Lv, J., Tang, R., Jia, S., Liu, Y., 2016. Experimental study on energy consumption of computer numerical control machine tools. *J. Clean. Prod.* 112, 3864–3874. doi:10.1016/j.jclepro.2015.07.040
- Lv, J., Tang, R., Tang, W., Liu, Y., Zhang, Y., Jia, S., 2017. An investigation into reducing the spindle acceleration energy consumption of machine tools. *J. Clean. Prod.* 143, 794–803. doi:10.1016/j.jclepro.2016.12.045
- Ma, F., Zhang, H., Cao, H., Hon, K.K.B.B., 2017. An energy consumption optimization strategy for CNC milling. *Int. J. Adv. Manuf. Technol.* 90, 1715–1726. doi:10.1007/s00170-016-9497-0
- Ma, J., Ge, X., Chang, S.I.I., Lei, S., 2014. Assessment of cutting energy consumption and energy efficiency in machining of 4140 steel. *Int. J. Adv. Manuf. Technol.* 74, 1701–1708. doi:10.1007/s00170-014-6101-3
- Maji, K., Pratihar, D.K., Nath, A. K., 2013. Experimental investigations and statistical analysis of pulsed laser bending of AISI 304 stainless steel sheet. *Opt. Laser Technol.* 49, 18–27. doi:10.1016/j.optlastec.2012.12.006
- Mativenga, P.T., Rajemi, M.F., 2011. Calculation of optimum cutting parameters based on minimum energy footprint. *CIRP Ann. - Manuf. Technol.* 60, 149–152. doi:10.1016/j.cirp.2011.03.088

- May, G., Stahl, B., Taisch, M., Kiritsis, D., Marco, T., Kiritsis, D., 2017. Energy management in manufacturing: From literature review to a conceptual framework. *J. Clean. Prod.* 167, 1464–1489. doi:10.1016/j.jclepro.2016.10.191
- Meng, Y., Wang, L., Lee, C.H., Ji, W., Liu, X., 2018. Plastic deformation-based energy consumption modelling for machining. *Int. J. Adv. Manuf. Technol.* 96, 631–641. doi:10.1007/s00170-017-1521-5
- Mert, G., Waltemode, S., Aurich, J.C., 2015. How services influence the energy efficiency of machine tools: A case study of a machine tool manufacturer. *Procedia CIRP* 29, 287–292. doi:10.1016/j.procir.2015.01.022
- Meudt, T., Metternich, J., Abele, E., 2017. Value stream mapping 4.0: Holistic examination of value stream and information logistics in production. *CIRP Ann. - Manuf. Technol.* 66, 413–416. doi:10.1016/j.cirp.2017.04.005
- Mohammadi, A., Züst, S., Mayr, J., Blaser, P., Sonne, M.R., Hattel, J.H., Wegener, K., 2017. A methodology for online visualization of the energy flow in a machine tool. *CIRP J. Manuf. Sci. Technol.* 19, 138–146. doi:10.1016/j.cirpj.2017.08.003
- Moradnazhad, M., Unver, H.O., 2017a. Energy efficiency of machining operations: A review. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 231, 1871–1889. doi:10.1177/0954405415619345
- Moradnazhad, M., Unver, H.O., 2017b. Energy consumption characteristics of turn-mill machining. *Int. J. Adv. Manuf. Technol.* 91, 1991–2016. doi:10.1007/s00170-016-9868-6
- Mori, M., Fujishima, M., Inamasu, Y., Oda, Y., 2011. A study on energy efficiency improvement for machine tools. *CIRP Ann. - Manuf. Technol.* 60, 145–148. doi:10.1016/j.cirp.2011.03.099
- Müller, E., Stock, T., Schillig, R., 2014. A method to generate energy value-streams in production and logistics in respect of time- and energy-consumption. *Prod. Eng.* 8, 243–251. doi:10.1007/s11740-013-0516-9
- Murthy, K.S., Rajendran, I., 2010. A study on optimisation of cutting parameters and prediction of surface roughness in end milling of aluminium under MQL machining. *Mach. Mach. Mater.* 7, 112.

References

- Nalbant, M., Gökkaya, H., Sur, G., 2007. Application of Taguchi method in the optimization of cutting parameters for surface roughness in turning. *Mater. Des.* 28, 1379–1385. doi:10.1016/j.matdes.2006.01.008
- Narita, H., Fujimoto, H., 2009. Analysis of Environmental Impact due to Machine Tool Operation. *Int. J. Autom. Technol.* 3, 49-55.
- Neugebauer, R., Wabner, M., Rentzsch, H., Ihlenfeldt, S., 2011. Structure principles of energy efficient machine tools. *CIRP J. Manuf. Sci. Technol.* 4, 136–147. doi:10.1016/j.cirpj.2011.06.017
- Newman, S.T., Nassehi, A., Imani-Asrai, R., Dhokia, V., 2012. Energy efficient process planning for CNC machining. *CIRP J. Manuf. Sci. Technol.* 5, 127–136. doi:10.1016/j.cirpj.2012.03.007
- Nguyen, T.-T., 2019. Prediction and optimization of machining energy, surface roughness, and production rate in SKD61. *Measurement* 136, 525–544.
- Niero, M., Pizzol, M., Bruun, H. G., Thomsen, M., 2014. Comparative life cycle assessment of wastewater treatment in Denmark including sensitivity and uncertainty analysis. *J. Clean. Prod.* 68, 25–35. doi: 10.1016/j.jclepro.2013.12.051
- O'Driscoir, E., Kelly, K., Cusack, D.O., O'Donnell, G.E., 2013. Characterising the energy consumption of machine tool actuator components using pattern recognition. *Procedia CIRP* 12, 127–132. doi:10.1016/j.procir.2013.09.023
- O'Driscoll, E., Cusack, O.D., O'Donnell, G.E., 2013. The development of energy performance indicators within a complex manufacturing facility. *Int. J. Adv. Manuf. Technol.* 68, 2205–2214. doi:10.1007/s00170-013-4818-z
- O'Driscoll, E., Kelly, K., O'Donnell, G.E., 2015. Intelligent energy based status identification as a platform for improvement of machine tool efficiency and effectiveness. *J. Clean. Prod.* 105, 184–195. doi:10.1016/j.jclepro.2015.01.058
- Okwudire, C., Rodgers, J., 2013. Design and control of a novel hybrid feed drive for high performance and energy efficient machining. *CIRP Ann. - Manuf. Technol.* 62, 391–394. doi:10.1016/j.cirp.2013.03.139
- Park, H.-S.S., Nguyen, T.-T.T., Dang, X.-P.P., 2016. Multi-objective optimization of turning process of hardened material for energy efficiency. *Int. J. Precis. Eng. Manuf.* 17, 1623–1631. doi:10.1007/s12541-016-0188-4

- Park, J., Law, K.H., Bhinge, R., Biswas, N., Srinivasan, A., Dornfeld, D. A., Helu, M., Rachuri, S., 2015. A Generalized Data-Driven Energy Prediction Model With Uncertainty for a Milling Machine Tool Using Gaussian Process. In: ASME 2015 International Manufacturing Science and Engineering Conference, p. V002T05A010. American Society of Mechanical Engineers. doi:10.1115/MSEC2015-9354
- Paul, S., Bandyopadhyay, P.P., Paul, S., 2018. Minimisation of specific cutting energy and back force in turning of AISI 1060 steel. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 232, 2019–2029. doi:10.1177/0954405416683431
- Pavanaskar, S., McMains, S., 2015. Machine specific energy consumption analysis for CNC-milling toolpaths, In: Proceedings of the ASME 2015 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference p. V01AT02A018. American Society of Mechanical Engineers.
- Peng, T., Xu, X., 2017. An interoperable energy consumption analysis system for CNC machining. *J. Clean. Prod.* 140, 1828–1841. doi:10.1016/j.jclepro.2016.07.083
- Peng, T., Xu, X., 2014a. Energy-efficient machining systems: A critical review. *Int. J. Adv. Manuf. Technol.* 72, 1389–1406. doi:10.1007/s00170-014-5756-0
- Peng, T., Xu, X., 2014b. A holistic approach to achieving energy efficiency for interoperable machining systems. *Int. J. Sustain. Eng.* 7(2), 111-129. doi:10.1080/19397038.2013.811558
- Peng, T., Xu, X., Heilala, J., 2013. Energy-Efficient Machining via Energy Data Integration. *Adv. Prod. Manag. Syst. Compet. Manuf. Innov. Prod. Serv.* 397, 17–24.
- Peng, T., Xu, X., Wang, L., 2014. A novel energy demand modelling approach for CNC machining based on function blocks. *J. Manuf. Syst.* 33, 196–208. doi:10.1016/j.jmsy.2013.12.004
- Peng, T.V., Xu, X., 2013. A universal hybrid energy consumption model for CNC machining systems, In: Re-Engineering Manufacturing for Sustainability. Springer, Singapore, p. 251–256. doi:https://doi.org/10.1007/978-981-4451-48-2_41
- Peralta Álvarez, M.E., Marcos Bárcena, M., Aguayo González, F., 2016. A Review of Sustainable Machining Engineering: Optimization Process Through Triple Bottom Line. *J. Manuf. Sci. Eng.* 138, 100801. doi:10.1115/1.4034277
- Pervaiz, S., Deiab, I., Rashid, A., Nicolescu, M., 2015. Prediction of energy consumption and environmental implications for turning operation using finite element analysis.

References

- Proc. Inst. Mech. Eng. Part B J. Eng. Manuf. 229, 1925–1932.
doi:10.1177/0954405414541105
- PMINDIA, 2014. Make In India. Major Initiatives. Available at: https://www.pmindia.gov.in/en/major_initiatives/make-in-india/ (Last accessed on 28 September 2019).
- Pontes, F.J., Ferreira, J.R., Silva, M.B., Paiva, A.P., Balestrassi, P.P., 2010. Artificial neural networks for machining processes surface roughness modeling. Int. J. Adv. Manuf. Technol. 49, 879–902.
- Pusavec, F., Deshpande, A., Yang, S., M'Saoubi, R., Kopac, J., Dillon, O.W., Jawahir, I.S., Dillon Jr., O.W., Jawahir, I.S., 2015. Sustainable machining of high temperature Nickel alloy - Inconel 718: Part 2 - Chip Breakability and Optimization. J. Clean. Prod. 87, 941–952. doi:10.1016/j.jclepro.2014.10.085
- Pušavec, F., Kopač, J., 2011. Sustainability assessment: cryogenic machining of Inconel 718. Strojníški Vestn. 9 (57), 637–647.
- Pusavec, F., Krajnik, P., Kopac, J., 2010. Transitioning to sustainable production – part I: application on machining technologies. J. Clean. Prod. 18, 174–184.
doi:10.1016/j.jclepro.2010.01.015
- Pušavec, F., Stoić, A., Kopač, J., 2010. Sustainable machining process-myth or reality. Strojarstvo 52, 197–204.
- Rahäuser, R., Klemm, P., Verl, A., Kircher, C., 2013. Increasing the energy efficiency in metal cutting manufacturing through a demand based coolant filtration, In: Re-Engineering Manufacturing for Sustainability. Springer Singapore Heidelberg New York Dordrecht London, p. 233–239. doi:10.1007/978-981-4451-48-2
- Rajemi, M.F., Mativenga, P.T., Aramcharoen, A., 2010. Sustainable machining: Selection of optimum turning conditions based on minimum energy considerations. J. Clean. Prod. 18, 1059–1065. doi:10.1016/j.jclepro.2010.01.025
- Rebitzer, G., Ekvall, T., Frischknecht, R., Hunkeler, D., Norris, G., Rydberg, T., Schmidt, W.P., Suh, S., Weidema, B.P., Pennington, D.W., 2004. Life cycle assessment Part 1: Framework, goal and scope definition, inventory analysis, and applications. Environ. Int. 30, 701–720. doi:10.1016/j.envint.2003.11.005

- Rentsch, R., Heinzel, C., 2015. Development of a discrete event model for energy and resource efficient milling. *Procedia CIRP* 31, 441–446. doi:10.1016/j.procir.2015.03.085
- Reuters, 2018. Global Machine Tools Market & Global Cutting Tools Market 2018 By Demand, Types, Advantages, Manufacturers, Production Cost, Revenue Generation, Growth & Forecast 2025. Available at: <https://www.reuters.com/brandfeatures/venture-capital/article?id=57741> (last accessed on 27 March 2019).
- Rief, M., Karpuschewski, B., Kalhöfer, E., 2017. Evaluation and modeling of the energy demand during machining. *CIRP J. Manuf. Sci. Technol.* 19, 62–71. doi:10.1016/j.cirpj.2017.05.003
- Saaty, T.L., 1980. The analytical hierarchical process: Planning, priority setting, resource allocation. Yew York USA.
- Sáez-Martínez, F.J., Lefebvre, G., Hernández, J.J., Clark, J.H., 2016. Drivers of sustainable cleaner production and sustainable energy options. *J. Clean. Prod.* 138, 1–7. doi:10.1016/j.jclepro.2016.08.094
- Salonitis, K., Ball, P., 2013. Energy efficient manufacturing from machine tools to manufacturing systems. *Procedia CIRP* 7, 634–639. doi:10.1016/j.procir.2013.06.045
- Samanta, B., Nataraj, C., 2008. Surface roughness prediction in machining using Computational Intelligence. *Int. J. Manuf. Res.* 3, 379–392. doi:doi:10.1504/IJMR.2008.0209
- Sangwa, N.R., Sangwan, K.S., 2018. Leanness assessment of organizational performance: a systematic literature review. *J. Manuf. Technol. Manag.* 29, 768–788. doi:10.1108/JMTM-09-2017-0196
- Sangwan, K.S., 2011. Development of a multi criteria decision model for justification of green manufacturing systems. *Int. J. Green Econ.* 5, 285–305. doi:10.1504/IJGE.2011.044239
- Sangwan, K.S., 2006. Performance Value Analysis for Justification of Green Manufacturing Systems. *J. Adv. Manuf. Syst.* 5, 59–73.

References

- Sangwan, K.S., Kant, G., 2017. Optimization of Machining Parameters for Improving Energy Efficiency using Integrated Response Surface Methodology and Genetic Algorithm Approach. *Procedia CIRP* 61, 517–522. doi:10.1016/j.procir.2016.11.162
- Sato, R., Shirase, K., Hayashi, A., 2017. Energy Consumption of Feed Drive Systems Based on Workpiece Setting Position in Five-Axis Machining Center. *J. Manuf. Sci. Eng.* 140, 021008. doi:10.1115/1.4037427
- Schlechtendahl, J., Eberspächer, P., Schraml, P., Verl, A., Abele, E., 2016. Multi-level Energy Demand Optimizer System for Machine Tool Controls. *Procedia CIRP* 41, 783–788. doi:10.1016/j.procir.2015.12.030
- Schmitt, R., Bittencourt, J.L., Bonefeld, R., 2011. Modelling Machine Tools for Self-Optimisation of Energy Consumption, In: *Glocalized Solutions for Sustainability in Manufacturing*. Springer-Verlag Berlin Heidelberg, p. 253–257. doi:10.1007/978-3-642-19692-8_44
- Schudeleit, T., Züst, S., Wegener, K., 2015. Methods for evaluation of energy efficiency of machine tools. *Energy* 93, 1964–1970. doi:10.1016/j.energy.2015.10.074
- Schudeleit, T., Züst, S., Weiss, L., Wegener, K., 2016. The Total Energy Efficiency Index for machine tools. *Energy* 102, 682–693. doi:10.1016/j.energy.2016.02.126
- Sealy, M.P., Liu, Z.Y., Zhang, D., Guo, Y.B., Liu, Z.Q., 2016. Energy consumption and modeling in precision hard milling. *J. Clean. Prod.* 135, 1591–1601.
- Shao, G., Brodsky, A., Shin, S.J., Kim, D.B., 2014. Decision guidance methodology for sustainable manufacturing using process analytics formalism. *J. Intell. Manuf.* doi:10.1007/s10845-014-0995-3
- Shen, N., Cao, Y., Li, J., Zhu, K., Zhao, C., 2018. A practical energy consumption prediction method for CNC machine tools : cases of its implementation. *Int. J. Adv. Manuf. Technol.*, 99, 2915-2927.
- Shi, K.N., Zhang, D.H., Liu, N., Wang, S.B., Ren, J.X., Wang, S.L., 2018. A novel energy consumption model for milling process considering tool wear progression. *J. Clean. Prod.* 184, 152–159. doi:10.1016/j.jclepro.2018.02.239
- Shin, S.-J., Woo, J., Rachuri, S., 2017. Energy efficiency of milling machining: Component modeling and online optimization of cutting parameters. *J. Clean. Prod.* 161, 12–29. doi:10.1016/j.watres.2017.08.068

- Shivakoti, I., Diyale, S., Kibria, G., Pradhan, B.B., 2012. Analysis of material removal rate using genetic algorithm approach. *Int. J. Sci. Eng. Res.* 3, 1–6.
- Shokrani, A., Dhokia, V., Newman, S.T., 2018. Energy conscious cryogenic machining of Ti-6Al-4V titanium alloy. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 232, 1690–1706. doi:10.1177/0954405416668923
- Shokrani, A., Dhokia, V., Newman, S.T., 2012. Environmentally conscious machining of difficult-to-machine materials with regard to cutting fluids. *Int. J. Mach. Tools Manuf.* 57, 83–101.
- Sihag, N., Sangwan, K.S., 2019. An improved micro analysis-based energy consumption and carbon emissions modeling approach for a milling center. *Int. J. Adv. Manuf. Technol.* 1–17. doi:10.1007/s00170-019-03807-x
- Sihag, N., Sangwan, K.S., Pundir, S., 2018. Development of a structured algorithm to identify the status of a machine tool to improve energy and time efficiencies. *Procedia CIRP* 69, 294–299. doi:10.1016/j.procir.2017.11.081
- Singh, S., Goodyer, J., Popplewell, K., 2007. Integrated environmental process planning for the design and manufacture of automotive components. *Int. J. Prod. Res.* 45, 4189–4205.
- Sivasakthivel, P.S., Murugan, V.V., Sudhakaran, R., 2012. Experimental evaluation of surface roughness for end milling of Al 6063: response surface and neural network model. *Int. J. Manuf. Res.* 7, 9-25. doi:10.1504/IJMR.2012.045241
- Sivasakthivel, P.S., Sudhakaran, R., Rajeswari, S., 2017. Optimization and sensitivity analysis of geometrical and process parameters to reduce vibration during end milling process. *Mach. Sci. Technol.* 21, 452–473. doi:10.1080/10910344.2017.1284564
- Song, S., Cao, H., Li, H., 2010. Evaluation method and application for carbon emissions of machine tools based on LCA, In: International Conference on Advanced Technology of Design and Manufacture. p. 74–78. doi:10.1049/cp.2010.1263
- Suhail, A.H., Ismail, N., Wong, S. V, Jalil, N.A.A., 2010. Optimization of cutting parameters based on surface roughness and assistance of workpiece surface temperature in turning process. *Am. J. Eng. Appl. Sci.* 3, 102–108.
- Tapoglou, N., Mehnen, J., Butans, J., Morar, N.I., 2016. Online on-board Optimization of Cutting Parameter for Energy Efficient CNC Milling. *Procedia CIRP* 40, 384–389. doi:10.1016/j.procir.2016.01.072

References

- Teiwes, H., Blume, S., Herrmann, C., Rössinger, M., Thiede, S., 2018. Energy load profile analysis on machine level. *Procedia CIRP* 69, 271–276. doi:10.1016/j.procir.2017.11.073
- Tranfield, D., Denyer, D., Smart, P., 2003. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review* Introduction: the need for an evidence- informed approach. *Br. J. Manag.* 14, 207–222.
- Triebel, M.J., Mendis, G.P., Zhao, F., Sutherland, J.W., 2018. Understanding Energy Consumption in a Machine Tool through Energy Mapping. *Procedia CIRP* 69, 259–264. doi:10.1016/j.procir.2017.11.041
- Tuo, J., Liu, F., Liu, P., 2018a. Key performance indicators for assessing inherent energy performance of machine tools in industries. *Int. J. Prod. Res.* 0, 1–14. doi:10.1080/00207543.2018.1508904
- Tuo, J., Liu, F., Liu, P., Zhang, H., Cai, W., 2018b. Energy efficiency evaluation for machining systems through virtual part. *Energy* 159, 172–183. doi:10.1016/j.energy.2018.06.096
- Tzeng, C.-J., Lin, Y.-H., Yang, Y.-K., Jeng, M.-C., 2009. Optimization of turning operations with multiple performance characteristics using the Taguchi method and Grey relational analysis. *J. Mater. Process. Technol.* 209, 2753–2759. doi:10.1016/j.jmatprotec.2008.06.046
- Um, J., Gontarz, A., Stroud, I., 2015. Developing energy estimation model based on sustainability KPI of machine tools. *Procedia CIRP* 26, 217–222. doi:10.1016/j.procir.2015.03.002
- Velchev, S., Kolev, I., Ivanov, K., Gechevski, S., 2014. Empirical models for specific energy consumption and optimization of cutting parameters for minimizing energy consumption during turning. *J. Clean. Prod.* 80, 139–149. doi:10.1016/j.jclepro.2014.05.099
- Vijayaraghavan, A., Dornfeld, D., 2010. Automated energy monitoring of machine tools. *CIRP Ann. - Manuf. Technol.* 59, 21–24. doi:10.1016/j.cirp.2010.03.042
- Wang, B., Liu, Z., Song, Q., Wan, Y., Shi, Z., 2016. Proper selection of cutting parameters and cutting tool angle to lower the specific cutting energy during high speed

- machining of 7050-T7451 aluminum alloy. *J. Clean. Prod.* 129, 292–304. doi:10.1016/j.jclepro.2016.04.071
- Wang, H., Xu, X., Zhang, C., Hu, T., 2018. A hybrid approach to energy-efficient machining for milled components via STEP-NC. *Int. J. Comput. Integr. Manuf.* 31, 442–456. doi:10.1080/0951192X.2017.1322220
- Wang, L., Wang, W., Liu, D., 2017. Dynamic feature based adaptive process planning for energy-efficient NC machining. *CIRP Ann. - Manuf. Technol.* 66, 441–444. doi:10.1016/j.cirp.2017.04.015
- Wang, Q., Liu, F., Wang, X., 2014a. Multi-objective optimization of machining parameters considering energy consumption. *Int. J. Adv. Manuf. Technol.* 71, 1133–1142. doi:10.1007/s00170-013-5547-z
- Wang, Q., Wang, X., Yang, S., 2014b. Energy consumption modelling of the machining system based on petri net. *Adv. Mech. Eng.* 2014. doi:10.1155/2014/324819
- Wang, Y., He, Y., Li, Y., Yan, P., Feng, L., 2015. An analysis framework for characterization of electrical power data in machining. *Int. J. Precis. Eng. Manuf.* 16, 2717–2723. doi:10.1007/s12541-015-0347-z
- Wang, Y.C., Kim, D.W., Katayama, H., Hsueh, W.C., 2018. Optimization of machining economics and energy consumption in face milling operations. *Int. J. Adv. Manuf. Technol.* 99, 2093–2100. doi:10.1007/s00170-018-1848-6
- Warsi, S.S., Jaffery, H.I., Ahmad, R., Khan, M., Akram, S., 2015. Analysis of Power and Specific Cutting Energy Consumption in Orthogonal Machining of Al 6061-T6 Alloys at Transitional Cutting Speeds. In: ASME 2015 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, 2015.
- Warsi, S.S., Jaffery, S.H.I., Ahmad, R., Khan, M., Agha, M.H., Ali, L., 2018a. Development and analysis of energy consumption map for high-speed machining of Al 6061-T6 alloy. *Int. J. Adv. Manuf. Technol.* 96, 91–102. doi:10.1007/s00170-018-1588-7
- Warsi, S.S., Jaffery, S.H.I., Ahmad, R., Khan, M., Ali, L., Agha, M.H., Akram, S., 2018b. Development of energy consumption map for orthogonal machining of Al 6061-T6 alloy. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 232, 2510–2522. doi:10.1177/0954405417703424

References

- Wei, Y., Hua, Z., Zhi-gang, J., Hon, K.K.B.B., 2018. A new multi-source and dynamic energy modeling method for machine tools. *Int. J. Adv. Manuf. Technol.* 95, 1–11. doi:10.1007/s00170-017-1545-x
- Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. *Int J Life Cycle Assess*, 21(9),1218–1230. doi: 10.1007/s11367-016-1087-8
- Winter, M., 2016. Eco-efficiency of grinding processes and systems. Springer International Publishing.
- Winter, M., Li, W., Kara, S., Herrmann, C., 2014. Determining optimal process parameters to increase the eco-efficiency of grinding processes. *J. Clean. Prod.* 66, 644-654. doi: 10.1016/j.jclepro.2013.10.031
- Wirtz, A., Meißner, M., Wiederkehr, P., Myrzik, J., 2018. Simulation-assisted investigation of the electric power consumption of milling processes and machine tools. *Procedia CIRP* 67, 87–92.
- Wójcicki, J., Leonesio, M., Bianchi, G., 2018. Integrated energy analysis of cutting process and spindle subsystem in a turning machine. *J. Clean. Prod.* 170, 1459–1472. doi:10.1016/j.jclepro.2017.09.234
- Wu, L., Li, C., Tang, Y., Yi, Q., 2017. Multi-objective Tool Sequence Optimization in 2.5D Pocket CNC Milling for Minimizing Energy Consumption and Machining Cost. *Procedia CIRP* 61, 529–534. doi:10.1016/j.procir.2016.11.188
- Xie, J., Liu, F., Qiu, H., 2016. An integrated model for predicting the specific energy consumption of manufacturing processes. *Int. J. Adv. Manuf. Technol.* 85, 1339–1346. doi:10.1007/s00170-015-8033-y
- Xie, N., Duan, M., Chinnam, R.B., Li, A., Xue, W., 2016. An Energy Modeling and Evaluation Approach for Machine Tools Using Generalized Stochastic Petri Nets. *J. Clean. Prod.* 113, 523–531. doi:10.1016/j.bmc.2010.04.023
- Xie, N., Zhou, J., Zheng, B., 2018. Selection of optimum turning parameters based on cooperative optimization of minimum energy consumption and high surface quality. *Procedia CIRP* 72, 1469–1474. doi:10.1016/j.procir.2018.03.099
- Xu, K., Luo, M., Tang, K., 2016. Machine based energy-saving tool path generation for five-axis end milling of freeform surfaces. *J. Clean. Prod.* 139, 1207–1223. doi:<http://dx.doi.org.ezproxy.javeriana.edu.co:2048/10.1016/j.jclepro.2016.08.140>

- Xu, K., Tang, K., 2016. Optimal Workpiece Setup for Time-Efficient and Energy-Saving Five-Axis Machining of Freeform Surfaces. *J. Manuf. Sci. Eng.* 139, 051003. doi:10.1115/1.4034846
- Yan, J., Li, L., 2013. Multi-objective optimization of milling parameters – the trade-offs between energy, production rate and cutting quality. *J. Clean. Prod.* 52, 462–471. doi:10.1016/j.jclepro.2013.02.030
- Yang, Y., Li, X., Gao, L., Shao, X., 2016. Modeling and impact factors analyzing of energy consumption in CNC face milling using GRASP gene expression programming. *Int. J. Adv. Manuf. Technol.* 87, 1247–1263. doi:10.1007/s00170-013-5017-7
- Yi, Q., Li, C., Tang, Y., Chen, X., 2015. Multi-objective parameter optimization of CNC machining for low carbon manufacturing. *J. Clean. Prod.* 95, 256–264. doi:10.1016/j.jclepro.2015.02.076
- Yingjie, Z., 2014. Energy efficiency techniques in machining process: A review. *Int. J. Adv. Manuf. Technol.* 71, 1123–1132. doi:10.1007/s00170-013-5551-3
- Yoon, H.S., Lee, J.Y., Kim, M.S., Ahn, S.H., 2014. Empirical power-consumption model for material removal in three-axis milling. *J. Clean. Prod.* 78, 54–62. doi:10.1016/j.jclepro.2014.03.061
- Yoon, H.S., Singh, E., Min, S., 2018. Empirical power consumption model for rotational axes in machine tools. *J. Clean. Prod.* 196, 370–381. doi:10.1016/j.jclepro.2018.06.028
- Yoon, H.S., Kim, E.S., Kim, M.S., Lee, J.Y., Lee, G.B., Ahn, S.H., 2015. Towards greener machine tools – A review on energy saving strategies and technologies. *Renew. Sustain. Energy Rev.* 48, 870–891. doi:10.1016/j.rser.2015.03.100
- Yusup, N., Zain, A.M., Hashim, S.Z.M., 2012. Evolutionary techniques in optimizing machining parameters: Review and recent applications (2007-2011). *Expert Syst. Appl.* 39, 9909–9927. doi:10.1016/j.eswa.2012.02.109
- Zein, A., Li, W., Herrmann, C., Kara, S., 2011. Energy Efficiency Measures for the Design and Operation of Machine Tools: An Axiomatic Approach, In: 18th CIRP International Conference on Life Cycle Engineering. p. 274–279.
- Zhang, C., Li, W., Jiang, P., Gu, P., 2017. Experimental investigation and multi-objective optimization approach for low-carbon milling operation of aluminum. *Proc. Inst. Mech. Eng. Part C J. Mech. Eng. Sci.* 231, 2753–2772. doi:10.1177/0954406216640574

References

- Zhang, C., Zhou, Z., Tian, G., Xie, Y., Lin, W., Huang, Z., 2016. Energy consumption modeling and prediction of the milling process: A multistage perspective. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 232, 095440541668227. doi:10.1177/0954405416682278
- Zhang, H., Deng, Z., Fu, Y., Lv, L., Yan, C., 2017a. A process parameters optimization method of multi-pass dry milling for high efficiency, low energy and low carbon emissions. *J. Clean. Prod.* 148, 174–184. doi:10.1016/j.jclepro.2017.01.077
- Zhang, H., Deng, Z., Fu, Y., Wan, L., Liu, W., 2017b. Optimization of process parameters for minimum energy consumption based on cutting specific energy consumption. *J. Clean. Prod.* 166, 1407–1414. doi:10.1016/j.jclepro.2017.08.022
- Zhang, H., Haapala, K.R., 2012. Integrating sustainability assessment into manufacturing decision making, In: *Leveraging Technology for a Sustainable World*. Springer, p. 551–556.
- Zhang, L., Zhang, B., Bao, H., Huang, H., 2018. Optimization of Cutting Parameters for Minimizing Environmental Impact: Considering Energy Efficiency, Noise Emission and Economic Dimension. *Int. J. Precis. Eng. Manuf.* 19, 613–624. doi:10.1007/s12541-018-0074-3
- Zhang, Y., 2014. Review of recent advances on energy efficiency of machine tools for sustainability. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* 229, 2095–2108. doi:10.1177/0954405414539490
- Zhang, Y., Zou, P., Li, B., Liang, S., 2015. Study on optimized principles of process parameters for environmentally friendly machining austenitic stainless steel with high efficiency and little energy consumption. *Int. J. Adv. Manuf. Technol.* 79, 89–99. doi:10.1007/s00170-014-6763-x
- Zhao, G., Guo, Y.B., Zhu, P., Zhao, Y., 2018. Energy Consumption Characteristics and Influence on Surface Quality in Milling. *Procedia CIRP* 71, 111–115. doi:10.1016/j.procir.2018.05.081
- Zhao, G., Hou, C., Qiao, J., Cheng, X., 2016. Energy consumption characteristics evaluation method in turning. *Adv. Mech. Eng.* 8, p. 1687814016680737. doi:10.1177/1687814016680737
- Zhao, G.Y., Liu, Z.Y., He, Y., Cao, H.J., Guo, Y.B., 2017. Energy consumption in machining: Classification, prediction, and reduction strategy. *Energy* 133, 142–157. doi:10.1016/j.energy.2017.05.110

- Zhong, Q., Tang, R., Lv, J., Jia, S., Jin, M., 2016a. Evaluation on models of calculating energy consumption in metal cutting processes: a case of external turning process. *Int. J. Adv. Manuf. Technol.* 82, 2087–2099. doi:10.1007/s00170-015-7477-4
- Zhong, Q., Tang, R., Peng, T., 2016b. Decision rules for energy consumption minimization during material removal process in turning. *J. Clean. Prod.* 140, 1819–1827. doi:10.1016/j.jclepro.2016.07.084
- Zhou, L., Li, J., Li, F., Mendis, G., Sutherland, J.W., 2018. Optimization Parameters for Energy Efficiency in End milling. *Procedia CIRP* 69, 312–317. doi:10.1016/j.procir.2017.12.005
- Zhou, L., Li, J., Li, F., Xu, X., Wang, L., Wang, G., Kong, L., 2017. An improved cutting power model of machine tools in milling process. *Int. J. Adv. Manuf. Technol.* 91, 2383–2400. doi:10.1007/s00170-016-9929-x
- Zhou, L., Li, J.J., Li, F., Meng, Q., Li, J.J., Xu, X., 2016. Energy consumption model and energy efficiency of machine tools: A comprehensive literature review. *J. Clean. Prod.* 112, 3721–3734. doi:10.1016/j.jclepro.2015.05.093