



REFERENCES

- Abed, M. H., & Kahar, M. N. M. (2023). Review on unrelated parallel machine scheduling problem with additional resources. In *Iraqi Journal for Computer Science and Mathematics* (Vol. 4, Issue 2, pp. 224–237). College of Education, Al-Iraqia University. <https://doi.org/10.52866/ijcsm.2023.02.02.020>
- Agnetis, A., Billaut, J.-C., Pinedo, M., & Shabtay, D. (2025). Fifty years of research in scheduling – theory and applications. *European Journal of Operational Research*. <https://doi.org/10.1016/j.ejor.2025.01.034>
- Aissi, H., Aloulou, M. A., & Kovalyov, M. Y. (2011). Minimizing the number of late jobs on a single machine under due date uncertainty. *Journal of Scheduling*, 14(4), 351–360. <https://doi.org/10.1007/s10951-010-0183-z>
- Allahverdi, A. (2015). The third comprehensive survey on scheduling problems with setup times/costs. In *European Journal of Operational Research* (Vol. 246, Issue 2, pp. 345–378). Elsevier B.V. <https://doi.org/10.1016/j.ejor.2015.04.004>
- Allahverdi, A., Gupta, J. N. D., & Aldowaisan, T. (1999). *A review of scheduling research involving setup considerations*. [https://doi.org/doi:10.1016/s0305-0483\(98\)00042-5](https://doi.org/doi:10.1016/s0305-0483(98)00042-5)
- Aloulou, M. A., & Della Croce, F. (2008). Complexity of single machine scheduling problems under scenario-based uncertainty. *Operations Research Letters*, 36(3), 338–342. <https://doi.org/10.1016/j.orl.2007.11.005>
- Avalos-Rosales, O., Angel-Bello, F., & Alvarez, A. (2015). Efficient metaheuristic algorithm and re-formulations for the unrelated parallel machine scheduling problem with sequence and machine-dependent setup times. *International Journal of Advanced Manufacturing Technology*, 76(9–12), 1705–1718. <https://doi.org/10.1007/s00170-014-6390-6>
- Bektur, G., & Saraç, T. (2019). A mathematical model and heuristic algorithms for an unrelated parallel machine scheduling problem with sequence-dependent setup times, machine eligibility restrictions and a common server. *Computers and Operations Research*, 103, 46–63. <https://doi.org/10.1016/j.cor.2018.10.010>



- Branda, M. (2018). Distributionally robust fixed interval scheduling on parallel identical machines under uncertain finishing times. *Computers and Operations Research*, 98, 231–239. <https://doi.org/10.1016/j.cor.2018.05.025>
- Bruni, M. E., & Khodaparasti, S. (2020). Tractable Risk Measures for the Selective Scheduling Problem with Sequence-Dependent Setup Times. *Communications in Computer and Information Science*, 1162 CCIS, 70–84. https://doi.org/10.1007/978-3-030-37584-3_4
- Camacho-Vallejo, J. F., Corpus, C., & Villegas, J. G. (2024). Metaheuristics for bilevel optimization: A comprehensive review. In *Computers and Operations Research* (Vol. 161). Elsevier Ltd. <https://doi.org/10.1016/j.cor.2023.106410>
- Chen, J., Chu, C., Sahli, A., & Li, K. (2024). A branch-and-price algorithm for unrelated parallel machine scheduling with machine usage costs. *European Journal of Operational Research*, 316(3), 856–872. <https://doi.org/10.1016/j.ejor.2024.03.011>
- Chen, J. F. (2009). Scheduling on unrelated parallel machines with Sequence- and Machine-dependent setup times and Due-date constraints. *International Journal of Advanced Manufacturing Technology*, 44(11–12), 1204–1212. <https://doi.org/10.1007/s00170-008-1917-3>
- Chen, J. F. (2015). Unrelated parallel-machine scheduling to minimize total weighted completion time. *Journal of Intelligent Manufacturing*, 26(6), 1099–1112. <https://doi.org/10.1007/s10845-013-0842-y>
- Chen, Y., Luo, H., Cai, Z., Wang, B., & Lu, X. (2025). A two-stage genetic algorithm-based robust scheduling approach for multi-factory production with uncertain shipping lead-time: Optimizing on-time delivery and cost. *Applied Soft Computing*, 171. <https://doi.org/10.1016/j.asoc.2024.112670>
- Cheng, T. C. E., & Sin, C. C. S. (1990). A state-of-the-art review of parallel-machine scheduling research. In *European Journal of Operational Research* (Vol. 47).
- Conway, R. W., Maxwell, W. L., & Miller, L. W. (1967). *THEORY OF SCHEDULING*.
- Daniels, R. L., & Carrillo, J. E. (1997). β -Robust scheduling for single-machine systems with uncertain processing times. *IIE Transactions (Institute of Industrial Engineers)*, 29(11), 977–985. <https://doi.org/10.1080/07408179708966416>



- Davis, E., & Jaffe, J. M. (1981). Algorithms for Scheduling Tasks on Unrelated Processors. In *Journal of the Association for Computing Machinery* (Vol. 28, Issue 4). <https://doi.org/https://doi.org/10.1145/322276.322284>
- de Weerd, M., Baart, R., & He, L. (2021). Single-machine scheduling with release times, deadlines, setup times, and rejection. *European Journal of Operational Research*, 291(2), 629–639. <https://doi.org/10.1016/j.ejor.2020.09.042>
- Drake, J. H., Kheiri, A., Özcan, E., & Burke, E. K. (2020). Recent advances in selection hyper-heuristics. In *European Journal of Operational Research* (Vol. 285, Issue 2, pp. 405–428). Elsevier B.V. <https://doi.org/10.1016/j.ejor.2019.07.073>
- Durasević, M., & Jakobović, D. (2023). Heuristic and metaheuristic methods for the parallel unrelated machines scheduling problem: a survey. *Artificial Intelligence Review*, 56(4), 3181–3289. <https://doi.org/10.1007/s10462-022-10247-9>
- Eiben, A. E., & Smit, S. K. (2011). Parameter tuning for configuring and analyzing evolutionary algorithms. In *Swarm and Evolutionary Computation* (Vol. 1, Issue 1, pp. 19–31). Elsevier B.V. <https://doi.org/10.1016/j.swevo.2011.02.001>
- Emami, S., Moslehi, G., & Sabbagh, M. (2017). A Benders decomposition approach for order acceptance and scheduling problem: a robust optimization approach. *Computational and Applied Mathematics*, 36(4), 1471–1515. <https://doi.org/10.1007/s40314-015-0302-8>
- Emami, S., Sabbagh, M., & Moslehi, G. (2016). A Lagrangian relaxation algorithm for order acceptance and scheduling problem: A globalised robust optimisation approach. *International Journal of Computer Integrated Manufacturing*, 29(5), 535–560. <https://doi.org/10.1080/0951192X.2015.1068452>
- Fanjul-Peyro, L. (2020). *Models and an exact method for the Unrelated Parallel Machine scheduling problem with setups and resources*. <https://doi.org/10.1016/j.eswax.2020.10>
- Feng, L., Chen, G., Zhou, S., Zhou, X., & Jin, M. (2024). An Energy-Efficient Unrelated Parallel Machine Scheduling Problem with Batch Processing and Time-of-Use Electricity Prices. *Mathematics*, 12(3). <https://doi.org/10.3390/math12030376>
- Gahm, C., Denz, F., Dirr, M., & Tuma, A. (2016). Energy-efficient scheduling in manufacturing companies: A review and research framework. *European Journal of Operational Research*, 248(3), 744–757. <https://doi.org/10.1016/j.ejor.2015.07.017>



- Ghorbanzadeh, M., & Ranjbar, M. (2023). Energy-aware production scheduling in the flow shop environment under sequence-dependent setup times, group scheduling and renewable energy constraints. *European Journal of Operational Research*, 307(2), 519–537. <https://doi.org/10.1016/j.ejor.2022.09.034>
- Gong, X., De Pessemier, T., Joseph, W., & Martens, L. (2015). An energy-cost-aware scheduling methodology for sustainable Manufacturing. *Procedia CIRP*, 29, 185–190. <https://doi.org/10.1016/j.procir.2015.01.041>
- Graham, R. L., Lawler, E. L., Lenstra, J. K., & Kan, A. H. G. R. (1979). *OPTIMIZATION AND APPROXIMATION IN DETERMINISTIC SEQUENCING AND SCHEDULING: A SURVEY*.
- Hadhbi, Y., Deroussi, L., Grangeon, N., Norre, S., & Blanchon, C. (2024). High Performance Algorithms for the Unrelated Parallel Machines Scheduling Problem with a Common Server and Job-Sequence Dependent Setup Times. *Communications in Computer and Information Science, 2016 CCIS*, 71–88. https://doi.org/10.1007/978-3-031-69257-4_6
- Helal, M., Rabadi, G., & Al-Salem, A. (2006). *Unrelated Parallel Machines Scheduling Problem with Setup Unrelated Parallel Machines Scheduling Problem with Setup Times Times*. https://digitalcommons.odu.edu/emse_fac_pubs
- Herrmann, J. W. (1999). *A Genetic Algorithm for Minimax Optimization Problems*. <https://doi.org/10.1109/CEC.1999.782545>
- Honkomp, S. J., Mockus, L., & Reklaitis, G. V. (1997). Robust Scheduling with Processing Time Uncertainty. In *Computers chem. Engng* (Vol. 21).
- Horowitz, E., & Sahni, S. (1976). Exact and Approximate Algorithms for Scheduling Nonidentical Processors. In *Journal of the Association for Computing Machinery* (Vol. 23, Issue 2).
- Hu, H., Ng, K. K. H., & Qin, Y. (2016). Robust Parallel Machine Scheduling Problem with Uncertainties and Sequence-Dependent Setup Time. *Scientific Programming*, 2016. <https://doi.org/10.1155/2016/5127253>
- Ibarra, O. H., & Kim, C. E. (1977). *Heuristic Algorithms for Scheduling Independent Tasks on Nonidentical Processors*.



- Ji, B., Zhang, S., Yu, S. S., & Zhang, D. (2023). An Enhanced Adaptive Large Neighborhood Search for Unrelated Parallel Machine Scheduling With Sequence Dependent Setup Times. *IEEE Access*, *11*, 16735–16748. <https://doi.org/10.1109/ACCESS.2023.3245825>
- Johnson, D. S., Aragon, C. R., Mcgeoch, L. A., & Schevon, C. (1989). *Optimization by Simulated Annealing* (Vol. 37, Issue 6).
- Joo, C. M., & Kim, B. S. (2015). Hybrid genetic algorithms with dispatching rules for unrelated parallel machine scheduling with setup time and production availability. *Computers and Industrial Engineering*, *85*, 102–109. <https://doi.org/10.1016/j.cie.2015.02.029>
- Kang, H. S., Lee, J. Y., Choi, S., Kim, H., Park, J. H., Son, J. Y., Kim, B. H., & Noh, S. Do. (2016). Smart manufacturing: Past research, present findings, and future directions. *International Journal of Precision Engineering and Manufacturing - Green Technology*, *3*(1), 111–128. <https://doi.org/10.1007/s40684-016-0015-5>
- Kasperski, A., Kurpisz, A., & Zieli, P. (2012). Parallel machine scheduling under uncertainty. In Salvatore Greco, Benedetto Matarazzo, & Bernadette Bouchon (Eds.), *Advances in Computational Intelligence (IPMU 2012)*. Springer. https://cs.pwr.edu.pl/zielinski/publications/papers/IPMU_final_version_25.pdf
- Kim, D.-W., Kim, K.-H., Jang, W., & Chen, F. F. (2002). Unrelated parallel machine scheduling with setup times using simulated annealing. In *Robotics and Computer Integrated Manufacturing* (Vol. 18).
- Kirkpatrick, S., Gelatt, ; C D, & Vecchi, ; M P. (1983). Optimization by Simulated Annealing. In *New Series* (Vol. 220, Issue 4598).
- Kurz, M. E., & Askin, R. G. (2001). Heuristic scheduling of parallel machines with sequence-dependent set-up times. *International Journal of Production Research*, *39*(16), 3747–3769. <https://doi.org/10.1080/00207540110064938>
- Larrañaga, Pedro., & Lozano, J. A. . (2002). *Estimation of distribution algorithms : a new tool for evolutionary computation*. Kluwer Academic Publishers.
- Lasi, H., Fettke, P., Kemper, H. G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. *Business and Information Systems Engineering*, *6*(4), 239–242. <https://doi.org/10.1007/s12599-014-0334-4>



- Lawler, E. L., Lenstra J. K., Rinnooy Kan, A. H. G., & Shmoys, D. B. (1989). *Sequencing and scheduling : algorithms and complexity*. www.tue.nl/taverne
- Lee, Y. S., Graham, E., Jackson, G., Galindo, A., & Adjiman, C. S. (2019). A comparison of the performance of multi-objective optimization methodologies for solvent design. In *Computer Aided Chemical Engineering* (Vol. 46, pp. 37–42). Elsevier B.V. <https://doi.org/10.1016/B978-0-12-818634-3.50007-2>
- Li, Z., Wang, Y., Han, Y., Gao, K., & Li, J. (2025). Q-Learning-Driven Accelerated Iterated Greedy Algorithm for Multi-Scenario Group Scheduling in Distributed Blocking Flowshops. *Knowledge-Based Systems*, 317. <https://doi.org/10.1016/j.knosys.2025.113424>
- Li, Z., Yang, H., Zhang, S., & Liu, G. (2016a). Unrelated parallel machine scheduling problem with energy and tardiness cost. *International Journal of Advanced Manufacturing Technology*, 84(1–4), 213–226. <https://doi.org/10.1007/s00170-015-7657-2>
- Lin, S. W., Lu, C. C., & Ying, K. C. (2011). Minimization of total tardiness on unrelated parallel machines with sequence- and machine-dependent setup times under due date constraints. *International Journal of Advanced Manufacturing Technology*, 53(1–4), 353–361. <https://doi.org/10.1007/s00170-010-2824-y>
- Lin, Y. K. (2013). Particle swarm optimization algorithm for unrelated parallel machine scheduling with release dates. *Mathematical Problems in Engineering*, 2013. <https://doi.org/10.1155/2013/409486>
- Liu, M., Liu, X., Chu, F., Zheng, F., & Chu, C. (2019). Service-oriented robust parallel machine scheduling. *International Journal of Production Research*, 57(12), 3814–3830. <https://doi.org/10.1080/00207543.2018.1497311>
- Mastrolilli, M., Mutsanas, N., & Svensson, O. (2013). Single machine scheduling with scenarios. *Theoretical Computer Science*, 477, 57–66. <https://doi.org/10.1016/j.tcs.2012.12.006>
- Mokotoff, E., & Chr, P. (2021). *A cutting plane algorithm for the unrelated parallel machine scheduling problem*. [https://doi.org/10.1016/S0377-2217\(01\)00270-3](https://doi.org/10.1016/S0377-2217(01)00270-3)



- Mucciarni, M., Caselli, G., De Santis, D., Iori, M., & Miranda-Bront, J. J. (2024). *On incorporating variable consumption functions within energy-efficient parallel machine scheduling*. <http://arxiv.org/abs/2412.17055>
- Naji, W., Espinouse, M. L., & Cung, V. D. (2015). Towards a robust scheduling on unrelated parallel machines: A scenarios based approach. *Advances in Intelligent Systems and Computing*, 360, 343–355. https://doi.org/10.1007/978-3-319-18167-7_30
- Opoku, R. K., & Li, X. (2025). Sustainable management practices, operational and sustainable performance in manufacturing contexts: empirical evidence from a developing economy. *Journal of Responsible Production and Consumption*, 2(1), 48–82. <https://doi.org/10.1108/JRPC-07-2024-0035>
- Panos Kouvelis, & Gang Yu. (1997). *Robust Discrete Optimization and Its Applications*. Kluwer Academic Publishers. <https://doi.org/10.1007/978-1-4757-2620-6>
- Parichehreh, M., Gholizadeh, H., Fathollahi-Fard, A. M., & Wong, K. Y. (2024). An energy-efficient unrelated parallel machine scheduling problem with learning effect of operators and deterioration of jobs. *International Journal of Environmental Science and Technology*. <https://doi.org/10.1007/s13762-024-05595-8>
- Parker, R. G., Deane, R. H., & Holmes, R. A. (1977). On the use of a vehicle routing algorithm for the parallel processor problem with sequence dependent changeover costs. *AIIE Transactions*, 9(2), 155–160. <https://doi.org/10.1080/05695557708975137>
- Perez Bernal, C., Salido, M. A., & March Moya, C. (2025). Optimizing energy efficiency in unrelated parallel machine scheduling problem through reinforcement learning. *Information Sciences*, 693. <https://doi.org/10.1016/j.ins.2024.121674>
- Pfund, M., Fowler, J. W., & Gupta, J. N. D. (2004). A survey of algorithms for single and multi-objective unrelated parallel-machine deterministic scheduling problems. *Journal of the Chinese Institute of Industrial Engineers*, 21(3), 230–241. <https://doi.org/10.1080/10170660409509404>
- Pinedo, M. L. (2022). *Scheduling: Theory, Algorithms and Systems* (6th edition). Springer. <https://doi.org/https://doi.org/10.1007/978-3-031-05921-6>
- Randhawa, S. U., & Smith, T. A. (1995). An experimental investigation of scheduling non-identical, parallel processors with sequence-dependent set-up times and due dates.



<https://doi.org/10.1080/00207549508930137>

- Rocha, P. L., Ravetti, M. G., Mateus, G. R., & Pardalos, P. M. (2008). Exact algorithms for a scheduling problem with unrelated parallel machines and sequence and machine-dependent setup times. *Computers and Operations Research*, 35(4), 1250–1264. <https://doi.org/10.1016/j.cor.2006.07.015>
- Saberi-Aliabad, H., Reisi-Nafchi, M., & Moslehi, G. (2020). Energy-efficient scheduling in an unrelated parallel-machine environment under time-of-use electricity tariffs. *Journal of Cleaner Production*, 249. <https://doi.org/10.1016/j.jclepro.2019.119393>
- Sagnol, G., Barner, C., Borndörfer, R., Grima, M., Seeling, M., Spies, C., & Wernecke, K. (2018a). Robust allocation of operating rooms: A cutting plane approach to handle lognormal case durations. *European Journal of Operational Research*, 271(2), 420–435. <https://doi.org/10.1016/j.ejor.2018.05.022>
- Sagnol, G., Barner, C., Borndörfer, R., Grima, M., Seeling, M., Spies, C., & Wernecke, K. (2018b). Robust allocation of operating rooms: A cutting plane approach to handle lognormal case durations. *European Journal of Operational Research*, 271(2), 420–435. <https://doi.org/10.1016/j.ejor.2018.05.022>
- Sanati, H., Moslehi, G., & Reisi-Nafchi, M. (2023). Unrelated parallel machine energy-efficient scheduling considering sequence-dependent setup times and time-of-use electricity tariffs. *EURO Journal on Computational Optimization*, 11. <https://doi.org/10.1016/j.ejco.2022.100052>
- Sekkal, D. N., & Belkaid, F. (2023). A multi-objective optimization algorithm for flow shop group scheduling problem with sequence dependent setup time and worker learning. *Expert Systems with Applications*, 233. <https://doi.org/10.1016/j.eswa.2023.120878>
- Seo, K. K., & Chung, B. Do. (2014). Robust optimization for identical parallel machine scheduling with uncertain processing time. *Journal of Advanced Mechanical Design, Systems and Manufacturing*, 8(2). <https://doi.org/10.1299/jamdsm.2014jamdsm0015>
- Shabtay, D., & Gilenson, M. (2023). A state-of-the-art survey on multi-scenario scheduling. In *European Journal of Operational Research* (Vol. 310, Issue 1, pp. 3–23). Elsevier B.V. <https://doi.org/10.1016/j.ejor.2022.11.014>



- Song, G., & Leus, R. (2022). Parallel machine scheduling under uncertainty: Models and exact algorithms. *INFORMS Journal*. <https://doi.org/10.1287/ijoc.2022.1229>
- T'kindt, V., & Billaut, J.-C. (2005). *Multicriteria Scheduling : Theory, Models and Algorithms*.
- Vallada, E., & Ruiz, R. (2011). A genetic algorithm for the unrelated parallel machine scheduling problem with sequence dependent setup times. *European Journal of Operational Research*, 211(3), 612–622. <https://doi.org/10.1016/j.ejor.2011.01.011>
- Wang, M., & Pan, G. (2019). A Novel Imperialist Competitive Algorithm with Multi-Elite Individuals Guidance for Multi-Object Unrelated Parallel Machine Scheduling Problem. *IEEE Access*, 7, 121223–121235. <https://doi.org/10.1109/ACCESS.2019.2937747>
- Wang, W., Gao, C., & Shi, L. (2023). Robust Optimization on Unrelated Parallel Machine Scheduling With Setup Times. *IEEE Transactions on Automation Science and Engineering*, 20(1), 346–360. <https://doi.org/10.1109/TASE.2022.3151611>
- Wang, Y., Han, Y., Wang, Y., & Liu, Y. (2024). Energy-efficient optimization for distributed blocking hybrid flowshop scheduling: a self-regulating iterative greedy algorithm under makespan constraint. *Optimization and Engineering*. <https://doi.org/10.1007/s11081-024-09911-6>
- Weng, M. X., Lu, J., & Ren, H. (2001). Unrelated parallel machine scheduling with setup consideration and a total weighted completion time objective. In *Int. J. Production Economics* (Vol. 70).
- Windras Mara, S. T., Norcahyo, R., Jodiawan, P., Lusiantoro, L., & Rifai, A. P. (2022). A survey of adaptive large neighborhood search algorithms and applications. In *Computers and Operations Research* (Vol. 146). Elsevier Ltd. <https://doi.org/10.1016/j.cor.2022.105903>
- Wu, X., Guo, P., Wang, Y., & Wang, Y. (2022). Decomposition approaches for parallel machine scheduling of step-deteriorating jobs to minimize total tardiness and energy consumption. *Complex and Intelligent Systems*, 8(2), 1339–1354. <https://doi.org/10.1007/s40747-021-00601-9>
- Xia, Y., Chen, B., & Yue, J. (2008). Job sequencing and due date assignment in a single machine shop with uncertain processing times. *European Journal of Operational Research*, 184(1), 63–75. <https://doi.org/10.1016/j.ejor.2006.10.058>



- Xu, X. (2012). From cloud computing to cloud manufacturing. *Robotics and Computer-Integrated Manufacturing*, 28(1), 75–86. <https://doi.org/10.1016/j.rcim.2011.07.002>
- Xu, X., Cui, W., Lin, J., & Qian, Y. (2013). Robust makespan minimisation in identical parallel machine scheduling problem with interval data. *International Journal of Production Research*, 51(12), 3532–3548. <https://doi.org/10.1080/00207543.2012.751510>
- Yang, J. (2002). On the Robust Single Machine Scheduling Problem. In *Journal of Combinatorial Optimization* (Vol. 6).
- Yazdani, M., & Haghani, M. (2024). Exploring the evolution of machine scheduling through a computational approach. *Engineering Applications of Artificial Intelligence*, 133. <https://doi.org/10.1016/j.engappai.2024.108572>
- Yue, F., Song, S., Zhang, Y., Gupta, J. N. D., & Chiong, R. (2018). Robust single machine scheduling with uncertain release times for minimising the maximum waiting time. *International Journal of Production Research*, 56(16), 5576–5592. <https://doi.org/10.1080/00207543.2018.1463473>
- Zeidi, J. R., & MohammadHosseini, S. (2015). Scheduling unrelated parallel machines with sequence-dependent setup times. *International Journal of Advanced Manufacturing Technology*, 81(9–12), 1487–1496. <https://doi.org/10.1007/s00170-015-7215-y>
- Zhang, A., Qi, X., & Li, G. (2020). Machine scheduling with soft precedence constraints. *European Journal of Operational Research*, 282(2), 491–505. <https://doi.org/10.1016/j.ejor.2019.09.041>
- Zhang, N., Zhang, Y., Song, S., & Chen, C. L. P. (2024). A Review of Robust Machine Scheduling. *IEEE Transactions on Automation Science and Engineering*, 21(2), 1323–1334. <https://doi.org/10.1109/TASE.2023.3246223>
- Zhang, X., Angel, E., Chu, F., & Regnault, D. (2024). Minimizing total completion time and makespan for a multi-scenario bi-criteria parallel machine scheduling problem. *European Journal of Operational Research*, 1–10. <https://doi.org/10.1016/j.ejor.2024.09.032>