Gears research group

Gears research group focuses on advanced mechanical engineering, gear technology, and manufacturing precision through a comprehensive portfolio of theoretical, virtual, and experimental projects. A major pillar of our activity involves the virtual simulation and accuracy analysis of gear systems, alongside the numerical modeling and experimental study of tooth surface load distributions. We also deal with advanced manufacturing simulation and surface optimization, focusing on improving 3D surface quality through virtual material removal and the optimization of successive 3D solid subtraction methods. Furthermore, we investigate innovative gear geometries – such as compensated cosine profile gears – by analyzing the relative sliding between flanks, root stress distribution and manufacturing errors. Our work also extends to the conceptual refinement, technological enhancement, and precision improvement of gear cutting tools, focusing almost on Fellow's cutters, gear hobs and milling heads. Considering also the modern manufacturing trends, our group explores gear production possibilities through additive manufacturing to bridge the gap between rapid prototyping and high-performance industrial applications. Definition and evaluation of 3D-printed gears wear mechanism constitutes one of the major interests in this field.

Members

- dr. Máté Márton
- dr. Hollanda Dénes
- dr. Tolvaly-Roşca Ferenc
- dr. Egyed-Faluvégi Erzsébet
- dr. Kántor József
- dr. Gergely Attila Levente
- drd. Hodgyai Norbert
- drd. Gál Károly István

Partner institutions

- Transilvania University of Braşov, Romania
- University of Nyíregyháza, Hungary
- John von Neumann University, Hungary
- "Óbuda" University of Budapest, Hungary
- University of Miskolc, Hungary
- Budapest University of Technology and Economics, Hungary

Research Grants

- Klebelsberg Kuno scholarship.

- MTA Domus Scholarship
- Spiral teethed cylindical gear pair synthesis and manufacturing technology. Hungarian Academy of Sciences, Domus Hungarica sholarship nr. B2011061
- Development of a new type of cylindrical gear pair, wiith an increased load capacity, based on a new meshing principle. „John von Neumann”international scholarship for senior researchers Nr. SZERZ- 3596-1, identification code: A2-NJN-TOK-13-0009.

Recent publications

1. Máté, M., Tolvaly-Roșca, F., Hodgyai, N.; Drăgoi, M.V.: A new approach of defining the grinding wheel profile of the Gear Hob's Rake Face. in: 2022 IEEE 22nd International Symposium on Computational Intelligence and Informatics and 8th IEEE International Conference on Recent Achievements in Mechatronics, Automation, Computer Science and Robotics (CINTI-MACRo). 21-22 November 2022. Date Added to IEEE Xplore: 03 February 2023. DOI: 10.1109/CINTI-MACRo57952.2022.10029498. Publisher: IEEE
2. Hodgyai, N., Máté, M., Oancea, Gh., Dragoi, M.V. : Review: Gear Hobs—Cutting Tools and Manufacturing Technologies for Spur Gears: The State of the Art. Materials 2024, 17(13), 3219; DOI: 10.3390/ma17133219 , ISSN: 1996-1944. IF3.1
3. Egyed-Faluvégi, Erzsébet, Attila Levente Gergely, and József Kántor. "Dimensional Precision of Plastic Gear Tooth Profiles Produced by 3D Printing." Engineering Proceedings 113, no. 1 (2025): 38.
4. Hodgyai Norbert, Tolvaly-Roșca Ferenc, Máté Márton: A Comparison between a Classical and a Modified RootFillet. Papers on Technical Sciences vol. 15. (2021) 25–32.DOI: https://doi.org/10.33894/mtk-2021.15.06
5. Norbert HODGYAI, Márton MÁTÉ, Ferenc TOLVALY-ROȘCA, Mircea Viorel DRĂGOI: Peculiarities of the Grinding Process of a Gear Hob Helical Rake Face. Acta Universitatis Sapientiae, Electrical and Mechanical Engineering, 13 (2021) 39-51. DOI: 10.2478/auseme-2021-0004.
6. HODGYAI, N., DRĂGOI, M. V., TOLVALY-ROȘCA, F., MÁTÉ, M. About the Grinding of Gear Hob's Rake Face. Műszaki Tudományos Közlemények – International Scientific Series of the Transylvanian Museum Society, Vol. 16. (2022), pp. 31-35. https://doi.org/10.33894/mtk-2022.16.06 Hungarian version: https://doi.org/10.33895/mtk-2022.16.06
7. MÁTÉ, M., Gál, K.I., Tolvaly-Roșca, F. Koszinuszprofilú lefejtőléccel gyártott fogaskerékpár szintézise és CAD-vizsgálata (in Hungarian). (Synthesis and CAD-analysis of a cosine profiled generating rack defined spur gear pair.) Műszaki Tudományos Közlemények – International Scientific Series of the Transylvanian Museum Society, Vol. 19. (2023), pp. 25-30. https://eda.eme.ro/handle/10598/33573
8. GÁL, K.I., Máté, M. Egyenes fogú metszőkerekek profilhibájának tanulmányozása CAD-környezetben. (A study on profile errors of straight teeted gear shaper cutters in CAD-environment) Műszaki Tudományos Közlemények –

International Scientific Series of the Transylvanian Museum Society, Vol. 18. (2023), pp. 29-36. https://doi.org/10.33895/mtk-2023.18.06. https://eda.eme.ro/handle/10598/33584
9. Hodgyai N., Drăgoi M.V. , Máté M.: Gear Hob Base Worm Modelling from a Straight Toothed Generating Rack. Műszaki Tudományos Közlemények – International Scientific Series of the Transylvanian Museum Society, vol. 20. (2024) 24–29. https://doi.org/10.33894/mtk-2024.20.05
10. HORVÁTH, R., GÁL, K. I., MÁTÉ, M., SIKOLYA, L: The Geometry and the Sliding Properties of a Generalized Cosine Spur Gear Drive. Acta Universitatis Sapientiae, Electrical and Mechanical Engineering, 17 (2025) 1–16. DOI: 10.47745/auseme-2025-0001.
11. Gergely,A., Kovács, ZS. F., Líska, J., Póka, Gy., Csorba, B., MÁTÉ, M. Műanyag fogaskerék koptató berendezés és matematikai modellezése. (The development of a plastic gear wear machine and it's matheamtical model) Gradus 11(1), January 2024, https://doi.org/10.47833/2024.1.ENG.011
12. Líska, J., Csorba, B., Póka, Gy., Gergely, A., MÁTÉ, M., Kovács, ZS. F. Szimulációs vizsgálati lehetőségek a fogaskerekek működése közben.(Simulation test capabilities of gears during operating.) Gradus 11(1), January 2024, https://doi.org/10.47833/2024.1.ENG.009.
13. Póka, Gy., Gergely, A., MÁTÉ, M., Kovács, ZS. F., Csorba, B., Líska, J. Evolvens profilú hengeres fogaskerék kontúrjának analitikus leírása. (Analythic description of involute profiled spur gears) Gradus 11(1), January 2024. https://doi.org/10.47833/2024.1.ENG.010.
14. HODGYAI, N., MÁTÉ, M., DRĂGOI, M.V., TOLVALY-ROȘCA, F.: Csigamarók aktív felületeinek 3D mérés utáni kiértékelése (Evaluation of Gear Hob Teeth Active Surface on 3D Measuring Data). 33rd International Conference on Mechanical Engineering. OGÉT-2025.2025. Nagyvárad / Oradea, 8-11. mai, 2025. ISSN 2668-9685. ISSN-L 2068-1267. https://ojs.emt.ro/oget/article/view/1927 pp.213-220.
15. GÁL, K.I., HORVÁTH, R., MÁTÉ, M., TOLVALY-ROȘCA, F.: Koszinusz profilú fogaskerék és csiga kapcsolódásának szimulációja. (Simulation of Reciprocate Meshing of a Cosine Gear and a Worm). 33rd International Conference on Mechanical Engineering. OGÉT-2025.2025. Nagyvárad / Oradea, 8-11. mai, 2025. ISSN 2668-9685. ISSN-L 2068-1267. https://ojs.emt.ro/oget/article/view/2003 pp.530-537.