Wrocław, March 31, 2021.

RANGE OF DIPLOMA DISSERATTION
for main field of study

POWER ENGINEERING
2nd level of education

specialization: ***Computer aided mechanical and power engineering***

1. Main elements and types of the HVAC (Heating, Ventilation, Air Conditioning) system.
2. Simulation and modeling of HVAC (Heating, Ventilation, Air Conditioning) components and work.
3. Methods of thermoeconomic analysis of energy processes.
4. Computer methods and tools in LCA (Life-Cycle Assessment) research.
5. General idea of Finite Volume Discretization.
6. Multi-domain modeling in OpenFOAM.
7. Electronic methods of measurement of displacement, velocity and acceleration.
8. Programmable Logic Controllers - structure, applications, programming languages.
9. Types and methods of artificial neural networks learning.
10. Types and methods of machine learning.
11. Radiation heat transfer, basic laws describing this process, calculation methods and procedures.
12. Multiphase flow - basic definitions, dimensionless numbers, and calculation methods.
13. Equations describing the thermal-flow processes used in the analysis by the finite volume method.
14. Turbulence models and their implementation in CFD software.
15. Low-dimensional reactors. Governing equations and applications.
16. Thermochemistry. Theoretical flame temperature. Heat of reaction.
17. Superconductivity state - properties and theory.
18. Superfluidity state - properties and theory.
19. Fuel-solar hybrid power technology.
20. The thermal efficiency of power station. What are benefits of any increase in the efficiency of energy conversion process. Ways to increase the efficiency of power energy production.
21. Describe basic differences between interpolation and approximation methods.
22. Describe the main assumptions underlying the problem of root finding methods. Present in details one of selected root finding method.
23. Describe rapid prototyping methods in the context of Integrated Production Systems.
24. Definition of CAPP (Computer Aided Process Planning) system and its application in production systems.
25. Advantages, disadvantages and limitations of FEA (Finite Element Analysis) method.
26. What is the Finite Element Method? What are the assumptions of FEM?
27. What are the parallel computations and where are they implemented?
28. Compare the method of finite differences (FDM), finite volumes (FVM) and finite elements (FEM) used in solving differential equations of mathematical physics.
29. Discuss the correct setting of boundary conditions in the second order differential equations basing on e.g. Poisson equation. Which physical situations do they correspond to?
30. Give mathematical definitions of the gradient, divergence, and rotation, interpret them physically and give examples of their appearance in partial differential equations of mathematical physics.