Final exam questions

Subject group name: **Computational Fluid Dynamics**

Neptun code: ZVEGEÁTBM04

Credit points: 4

Subject(s) in this subject group:

- **Computational Fluid Dynamics** (BMEGEÁTBM04)

Program: Mechatronics Engineer, BSc (2N-AM0)

Specialization(s): Mechanical Engineering Modelling

Responsible person(s):

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You can check the current subject forms at the Educational Portal of the Faculty of Mechanical Engineering.

https://oktatas.gpk.bme.hu/

Always check for updates at edu.gpk.bme.hu before preparing for the exam, especially if the subject group contains at least one subject from your final semester!

Valid from 1 September 2024

Dr. Gergely Kristóf

associate professor

1. Formulate the generic transport equation in integral form, explain the transport equation, and define the convective and conductive fluxes! What do we mean by the conservative property of the finite volume method?
2. Describe the elements of a numerical mesh. In which points are the discrete field variables localized in FLUENT system? In which zones should the numerical mesh be refined? What quality requirements are relevant for CFD meshes, and how does mesh quality affect the numerical errors? What is the advantage of streamlining the mesh?
3. Describe the physical and mathematical meaning of the boundary conditions applicable in the FLUENT system. Which of these options can be applied to compressible and incompressible flows? What approaches are possible for distributing flow between multiple outlets?
4. List the density models most commonly used in flow models. How can you estimate the optimum time step size for a compressible and an incompressible model? What do you need to know about modelling natural convection driven by density difference?
5. Please define the velocity, time, and length scales of turbulence! Explain the major turbulence model categories! Describe the k-epsilon model equations. What requirements need to be fulfilled by the mesh when using different turbulence models?
6. What thermal boundary conditions can be used for walls in a FLUENT system? What do we mean by optical depth? What kind of radiation heat transport models do you know?
7. Describe some applications of porous-jump and porous-zone models! What is the advantage of using internal walls? Please give some application examples! Give examples of using user-defined volume sources.
8. What approaches do you know for fluid machinery modelling?
9. Describe the main sources of errors and uncertainties in CFD! What methods can be used for error estimation? Describe the Richardson extrapolation!