McMaster University | Graduate Study | Dr Nik Popov
Engineering Physics | Course EP704

Reactor Thermal-Hydraulics Analysis

Student:	Test 1
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Reactor Thermal-Hydraulics Analysis

1. Explain the process of development of computer tools (programs), covering important steps, such as phenomena identification, performing experiments, code verification, validation, etc.
2. Explain your understanding of the linkage between thermal-hydraulic design and analysis.
3. What are the advantages and disadvantages of t/h models based on empirical correlations as compared to the models that rely more on equations derived from 1st principles? Can we develop models that do not need empirical correlations?
4. Explain the key features of the macroscopic and microscopic approach in modelling t/h phenomena, and provide examples of applications.
5. State the principle of conservation, and apply it on conservation pf mass, momentum and energy in an illustrative way.
6. How does the equation of state fit in the system of equations written for t/h phenomenon?
7. Explain the relationship between the mass, momentum and energy equations and the equation of state. Provide examples of different possible models for single and two-fluid applications.
8. Explain the principle of nodalization and the matrix representation of the mass conservation equation.
9. Explain the key features and differences between the iterative and rate method for developing the equation of state (cover the advantages and disadvantages of both methods).
10. Explain the approach used by the fully-implicit back-substitution (FIBS) method (use the example of a generic system of conservation differential equations).
11. What is the objective of the matrix representation of the set of conservation equations (solving for which key variables, and in which from)?
12. What is a difference between a link and a node, and how are they connected in a matrix representation of a system of conservation equations?
13. What is the difference between the fully explicit and fully implicit approach, and what is the key strategy in the Porsching approach?
14. What are the key differences between the CATHENA system of conservation equations, and the Porsching scheme?
15. Explain the importance of the flow regime criteria in a t/h analysis code. Provide examples of flow regimes in horizontal and vertical direction, and indicate importance with respect to the CANDU applications. Mention the CATHENA strategy with respect to the flow regime modelling.
16. Provide a brief explanation of the CATHENA calculation sequence (solution process).
17. List the CATHENA key constitutive correlations including mass, momentum and energy types.
18. Briefly explain the CATHENA heat transfer model for all parts of the boiling curve.