Nuclear Power and New Generation: Attractive Profession?

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Building a nuclear reactor...
Positive Reactivity Void Coefficient?

It is on the Internet 😊
reactivity void coefficient - Wikipedia, the free encyclopedia

In nuclear engineering, the void coefficient (more properly called "void coefficient of reactivity") is a number that can be used to estimate how much the...

void coefficient of reactivity - NRC: Glossary – Void coefficient of reactivity

Void coefficient of reactivity. A rate of change in the reactivity of a water reactor system resulting from a formation of steam bubbles as the power level...

Pressure Coefficient - Influence of a positive sodium void coefficient of reactivity on...

It is concluded that the safety of the reactor is not materially affected by the sodium void coefficient of reactivity. Hence, design variants aimed to make...
of coolant accident, which has other dangers). Some reactors operate with the coolant in a constant state of boiling, using the generated vapor to turn turbines.

The coolant liquid may act as a neutron absorber or as a neutron moderator. In either case, the amount of void inside the reactor can affect the reactivity of the reactor. The change in reactivity caused by a change of voids inside the reactor is directly proportional to the \textit{void coefficient}.

A positive void coefficient means that the reactivity increases as the void content inside the reactor increases due to increased boiling or loss of coolant; for example, if the coolant acts as a neutron absorber. If the void coefficient is large enough and control systems do not respond quickly enough, this can form a \textit{positive feedback} loop which can quickly boil all the coolant in the reactor. This happened in the Chernobyl disaster. \textbf{The construction of reactors with a positive void coefficient is illegal in the United States.}

A negative void coefficient means that the reactivity decreases as the void content inside the reactor increases - but it also means that the reactivity increases if the void content inside the reactor is reduced. In boiling-water reactors with large negative void coefficients, a sudden pressure rise (caused, for example, by unplanned closure of a steamline valve) will result in a sudden decrease in void content: the increased pressure will cause some of the steam bubbles to condense ("collapse"); and the thermal output will possibly increase until it is terminated by safety systems, by increased void formation due to the higher power, or, possibly, by system or component failures that relieve pressure, causing void content to increase and reactivity decreases. Boiling-water reactors are all designed for
Void coefficient of reactivity

A rate of change in the reactivity of a water reactor system resulting from a formation of steam bubbles as the power level and temperature increase.
Tribute to prof. Bill Garland of McMaster University:  

Tutorials and Class Recordings:

Occasional tutorials are held as requested. Supporting text and audio / screen capture recordings of the actual tutorials are given below. BDFlashback was used to create a self standing executable. Just download and run. Use the View command on the toolbar to adjust the movie size. File sizes are large but that is the best we can do at the moment. Check the schedule below for when the tutorials were/will be held.

2007 Session

- 2007.03.12
  - Class recordings
    - Overall plant behaviour and the role of the Heat Duty Diagram (exe 10.0Mb)
    - Heat Duty Diagram spreadsheet calculations: turbine power / grid synchronisation (exe 8.9Mb)
    - Feed and bleed, pressurizer, HTS stability (exe 4.4Mb)
    - Heat Transport System Thermohydraulics (pdf 280kb) - notes from Chapter 3 of course EP716. See section 3.9 in particular.
    - Simplified plant + Steam generator diagrams (pdf 150kb)
    - Heat duty diagram calculation (xls 58kb)

2006 Session

- 2006.01.03
  - Startup lecture (exe 12.8Mb)

- 2006.01.17
  - Ian Hall discussed PREPRO, a preprocessor for handling neutron and photon cross section data from the IAEA Nuclear Data Centre. Nice!
  - Discussion (exe 10.5Mb) on international organizations and data availability, quick demo of MNRSIM (McMaster Nuclear Reactor Simulator), a discussion on the central role of steam generators, and a question on the supercritical fluid reactor.

- 2006.01.24
  - Dave Gilbert demos MNRSIM (exe 23Mb), overheads (pdf 416kb), code download.
Remote learning
North West University  South Africa

Course Schedule 2010
Masters in Nuclear Engineering

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III take away points:

II ...it is on the internet!

III
Seeing is believing: CTU reactor
LWR & the void coefficient

Diagram showing the relationship between moderator-to-fuel ratio, $N^m/N^f$, and various parameters such as $k_{eff}$, resonance escape probability, and thermal utilization factor.
3 take away points:

- It is and is not on the internet!
- Not too remote remote learning!
- Attractive profession; but not like before!
There are modern books available also, e.g. for people keen on equations…