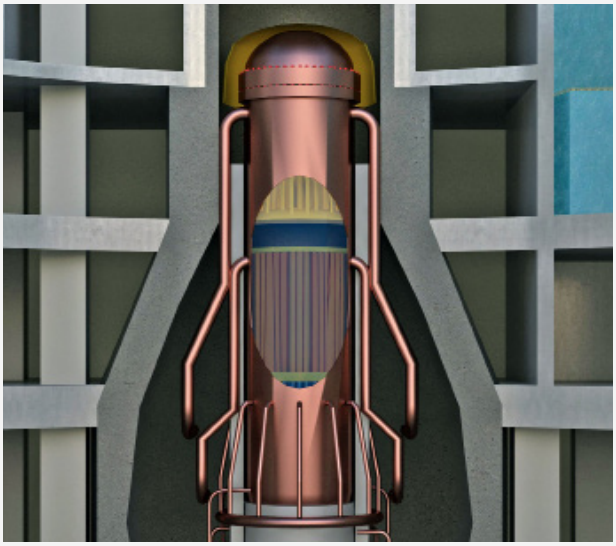
" SIMULATE5-K is an advanced, multi-group nodal code for LWR transient analysis. SIMULATE5-K delivers neutronic and thermal-hydraulic analysis with licensing-grade accuracy over a wide range of dynamic applications. SIMULATE5-K offers complete consistency with SIMULATE5 methods and results. "



Key Features

SIMULATE5-K (S5K) is an extension of the SIMULATE5 code, which is capable of modeling (PWR and BWR) light water reactor geometry. S5K merges and extends the SIMULATE-3K functionality into the SIMULATE5 code. S5K is a best-estimate nodal reactor analysis tool that employs advanced core neutronics coupled with detailed thermal-hydraulic channel models. Faithful modeling of assembly-by-assembly neutronic and thermal-hydraulic effects, including assembly pin power reconstruction, permits the application of S5K to a wide class of BWR, PWR and SMR transients.

S5K is built on the solid foundation of SIMULATE5, the industry-leading steady-state nodal reactor analysis code. S5K can be used to analyze a variety of core transients, for example, BWR stability analysis, reactivity insertion analysis, dynamic rod worth calculations, and anticipated operational events.

Core Neutronics

- Multigroup kinetics
- Extended cross section model
- Axial re-homogenization
- Macro/Micro cross section model

Core Channel TH

- Treatment of all the flow paths in the assembly
- Treatment of non-uniform water rod designs
- Evaluation of steam/water properties at local pressure conditions

Fuel Pin Model

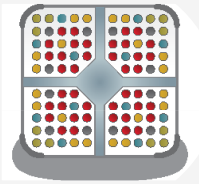
- Supports Accident Tolerant Fuel (ATF)
- Supports double cooled annular fuel

Address Emerging Issues

S5K helps operating utilities address emerging regulatory issues like pin enthalpy and delta-CPR limits. An explicit fuel pin conduction model tracks the complete radial distribution of fuel temperatures and enthalpies in every fuel pin in the core throughout a transient. S5K is capable of evaluating margin-to-thermal limits (such as delta CPR) during plant transients, providing licensing-grade support to core designers.

In addition, support is planned for NRC RG 1.236 requirements in S5K.

Applications



With a robust neutronics engine and advanced thermal-hydraulic capabilities, S5K is well-suited for transients with a strong neutronic/thermal-hydraulic coupling in PWRs, BWRs and VVERs. Its seamless linkage with SIMULATE5 makes S5K the perfect tool for the study of operational transients typically analyzed on a cycle-specific basis. Core designers simply generate the proposed core and seamlessly use S5K to evaluate the prescribed set of transients as part of the core reload design licensing process. For modeling whole-plant transients, S5K can be coupled with system codes like RELAP and TRACE. The powerful neutronics engine inside S5K guarantees a high-fidelity, 3D core neutronic solution in whole-plant transient simulations.

PWR Applications

S5K can provide licensing-grade support for analyzing PWR specific safety analyses, such as Reactivity Insertion Accidents (RIA) like ejected rods and inadvertent bank withdrawals, dropped rods, and boron dilution accidents.

BWR Applications

S5K can provide licensing-grade support for analyzing BWR specific safety analyses and fast operational occurrences where the primary acceptance criteria are fuel rod integrity. BWR analyses include reactor stability and reactivity insertion accidents (RIA) like dropped rods and inadvertent bank withdrawals.

Other Applications

In addition, Studsvik offers a separate SIMULATE5-K-VVER product for VVER plant designs.

Ease of Use

The S5K input format is simple to use, allowing freeformat input capable of modelling complex core transients. With practical defaults, robust error checking, and seamless interfaces to other Studsvik core analysis software, S5K allows engineers to spend their time analyzing, not troubleshooting.

Methodology

S5K leverages the power of SIMULATE5, the industry standard in nodal reactor analysis. By including cutting-edge neutronic methods and advanced engineering features, S5K delivers unparalleled fidelity with production-level run times. S5K solves the transient three-dimensional, multi-group neutron diffusion equations, including an N-group model for delayed neutron precursors. Intranodal flux and power distributions within each node are used to compute the power, fuel temperatures, and enthalpies for every axial level of every fuel pin in the core during transients.

Requirements for SIMULATE5-K

S5K is available for all standard computing platforms running most modern 64-bit operating systems. Linux and Windows architectures are supported environments for S5K. Studsvik's technical support is built on putting the needs of our customers first. Our nuclear engineering staff are here to help.

Benefits of S5K over S3K

- Planned to satisfy NRC RG1.236 requirements by developing new models for fission gas release, rod pressurization, oxide thickness and hydrogen uptake.
- S5K features multi-group capability, whereas S3K is limited to two groups.
- S5K provides a consistent extension of SIMULATE5 steady-state methods to transients.
- Based on the SIMULATE5 architecture, S5K inherits all advanced models and features in SIMULATE5, while reducing overall QA burden.

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