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The Transient Code System **SIM-ADS** for solid and fluid-fuelled reactor systems (critical and sub-critical)

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Topics

- **Objectives**
- **Application of Code to typical plant transients (comparison of results to other code systems) for different reactor designs**

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- Objective:
  - Perform transient analysis of both solid fuelled (pins) and fluid-fuelled reactor systems to typical plant transient initiators such as
    - » Reactivity insertions
    - » Loss of flow
    - » Loss of heat sink

- Modelling:
  - Neutronics
  - Thermohydraulics

- Application of SIM-ADS:
  - Benchmarking of SIM-ADS by comparing results to other code systems

    - » Fast reactors
      - Na and Pb or Pb/Bi cooled systems (PDS-XADS)
      - He-cooled (PDS-XADS project)

    - » Thermal reactors
      - LWR
      - HTR (He –cooled 200 MWth Module)
      - Molten Salt reactors (MOST project)

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General Capabilities of "SIM-ADS"

Fuel Types :
- UO_2 - Pins
- UO_2 / PuO_2 - Pins
- ThO_2 / UO_2 - Pins
- Circulating Fuels (molten salts)
- Coated Particles

Coolant Types:
- Na
- Pb / Pb-Bi
- H_20
- Salts
- He, or CO_2

Cladding Types:
- SS
- Zr

Other Materials:
- Graphite

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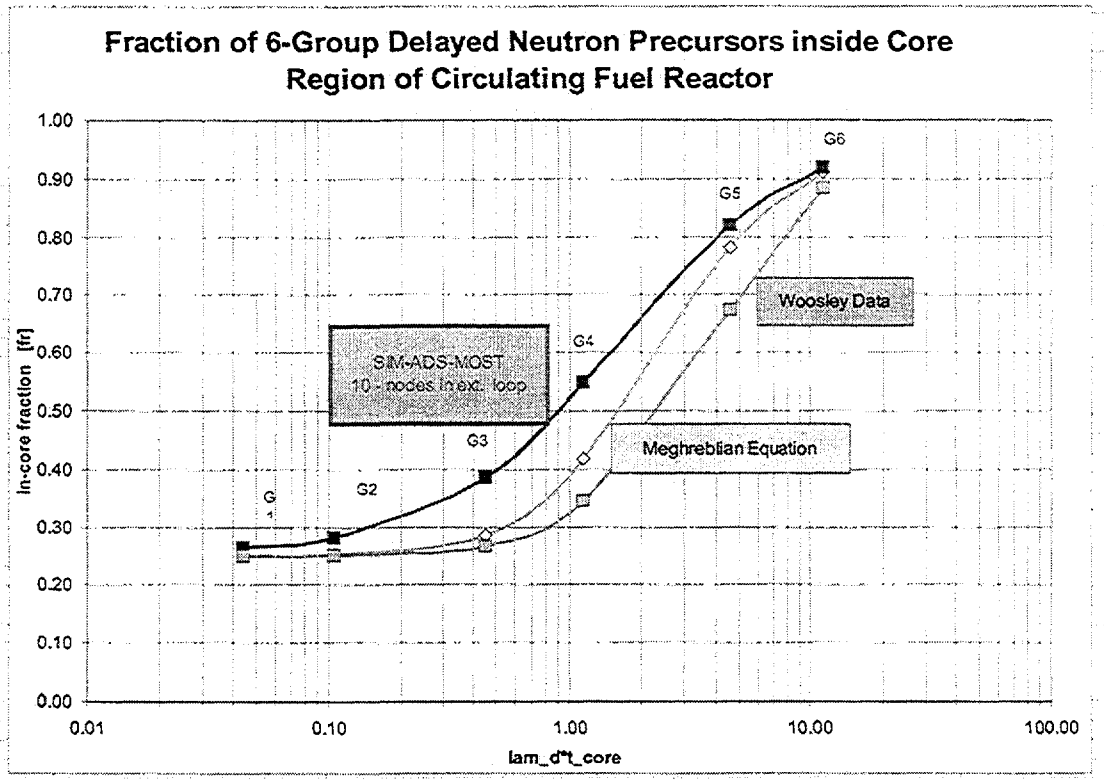
Benchmarking of Neutron Kinetics for Circulating Fuel Type Reactor, Molten Salt

Reactor Design: 700 MWth Molten Salt

Reference: Woosley, Rydin, „ Dynamic Analysis of an Accelerator-Driven Fluid-Fueled Subcritical Radioactive Waste Burning System", NSE:129, 15-50 (1998)

	[sec]		[1/s]	t_1/2 [sec]		
t_core	3.42	lam_d1	0.01292	53.56	w_c	2150
t_loop	10.26	lam_d1	0.03085	22.43	m_c	7353
t_tot	13.68	lam_d3	0.13202	5.24	v_c	7.65
		lam_d4	0.33634	2.06	v_l	7.65
		lam_d5	1.33216	0.52	lam	0.01292
		lam_d6	3.27160	0.21	w_l	2150
					m_l	22060

lam_d*t_core	del. neutr. Group	source: Meghreblian, pg. 599, eq. 9.214 fraction delayed neutrons in core	source:Excel model points fraction	source: Woosley fraction	equil. Model
0.044	1	0.250	0.264	0.25	0.274
0.105	2	0.252	0.283	0.251	0.305
0.452	3	0.286	0.386	0.267	0.440
1.150	4	0.419	0.548	0.345	0.597
4.556	5	0.783	0.820	0.674	0.830
11.189	6	0.911	0.918	0.885	0.920



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Conclusions :

1. The code system SIM-ADS was benchmarked against other transient code systems for critical and sub-critical configurations (reactor systems) by comparing the transient response to various plant transient initiators :

   - Reactivity insertion transients
   - LOF and ULOF transients
   - LOH and ULOH transients

- SIM-ADS is bench-marked for the following reactor types:

  - LWR
  - FBR (Na-cooled, Pb-cooled, CO2-cooled)
  - HTR
  - Molten Salt (fluid-fuelled)

- Current activities

  - Continue benchmarking to gas-cooled system, esp. Fast He- and CO2-cooled systems (pin type fuel)
    - » Depressurization transient
  - Coated Particle Fuel (Fast and thermal systems)
    - » Particles embedded in graphite matrix
    - » Fuel pins loaded with coated particle