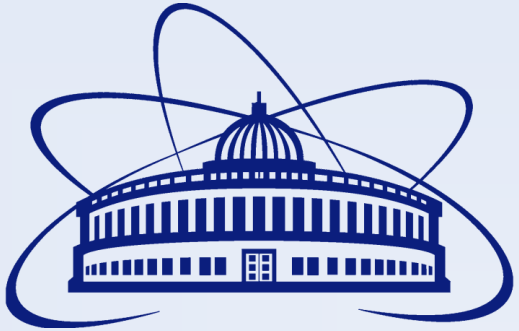

Dynamics model for the Neptune reactor

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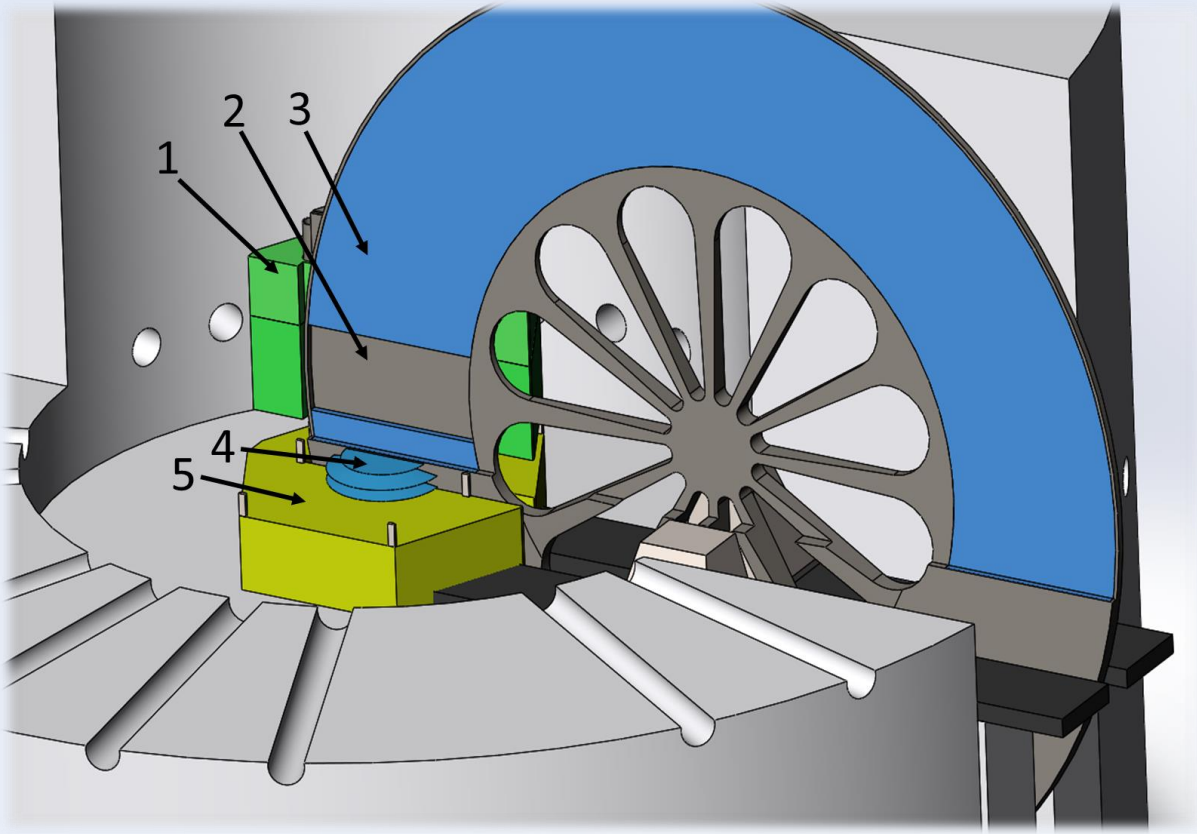
The Neptune reactor

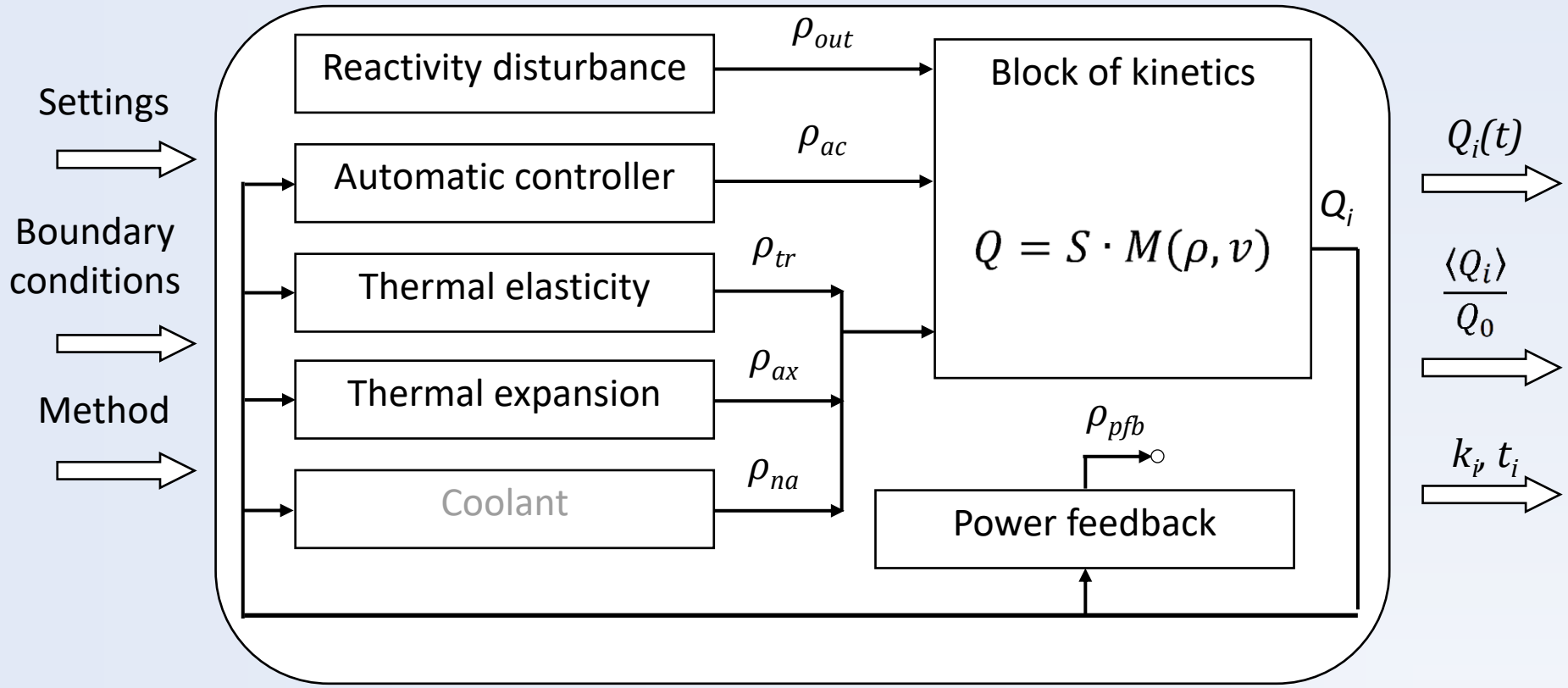
Parameters of reactor IBR-3 (NEPTUN)

Parameter	Value
Average thermal power, MW	15
Pulse frequency, Hz	10
Fuel / critical mass, kg	NpN/540
Coolant temperature at inlet/outlet (Na liquid, °C)	290/390
Effective fraction of delayed neutrons	0.0013
Prompt neutron generation time, ns	9 - 30
Effective duration of neutron pulse, μs	200 - 240
Background power, % of average power	2.5-3
Diameter of a fuel rod, mm	17.3
Height of a fuel column, mm	410
Fuel density, g/cm^3	13.4
Average neutron heat flux on the surface of the water moderator, 10^{14} cm^{-2}·s^{-1}	10

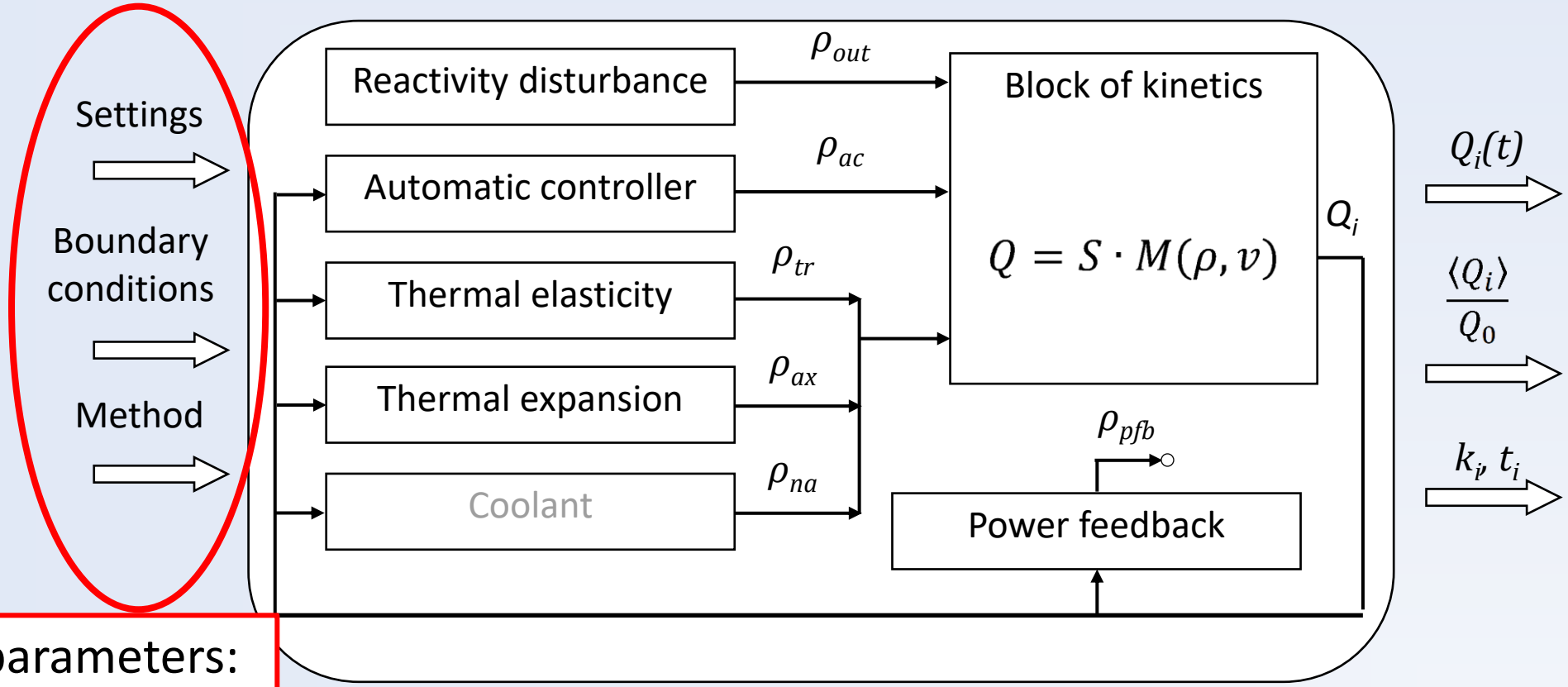


Design of reactor IBR-3 (NEPTUN)
1- reactor core, 2 - empty sector of reactivity modulator, 3 - reactivity modulator with titanium hydride (blue), 4 - moderator, 5 - beryllium reflector.

Structure of the program



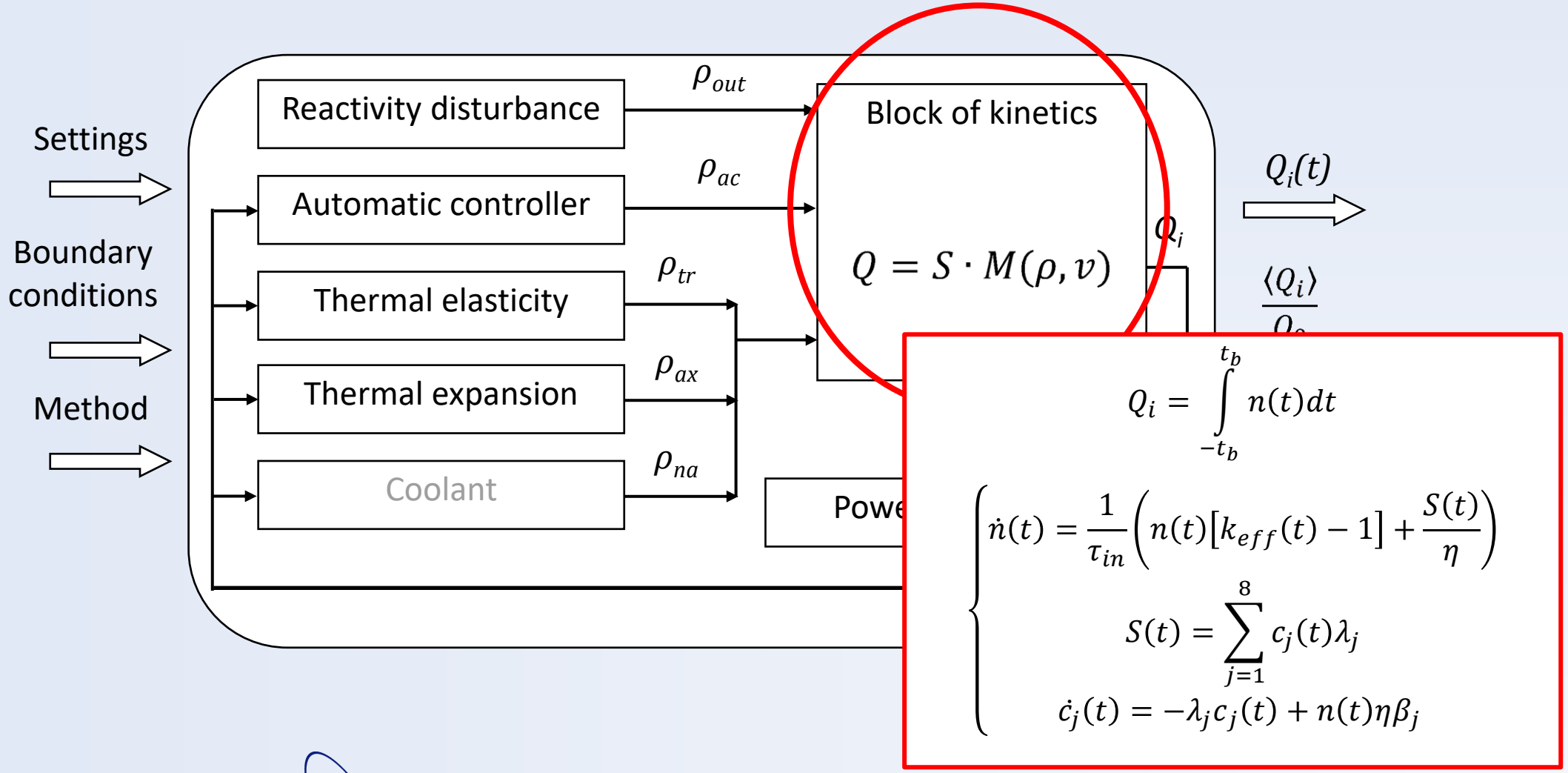
Structure of the program



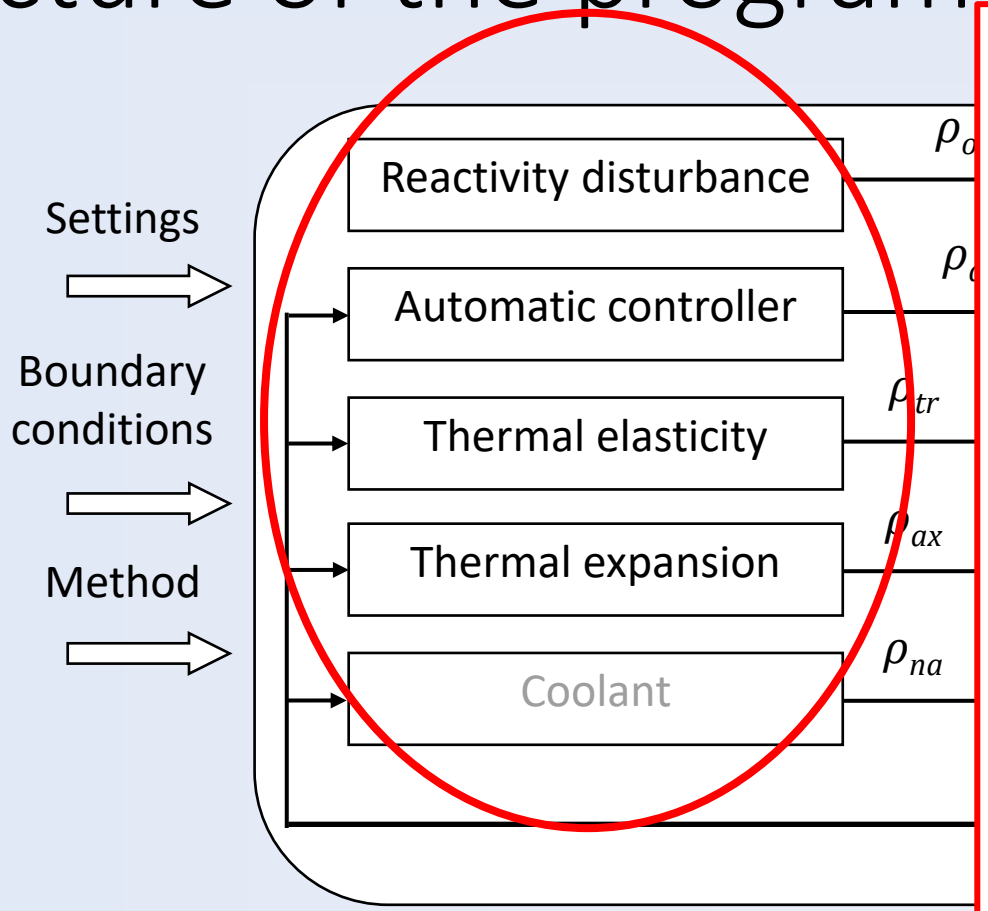
Input parameters:

pulse frequency ν;
reactor power P_0;
a method for calculating reactivity ρ etc.

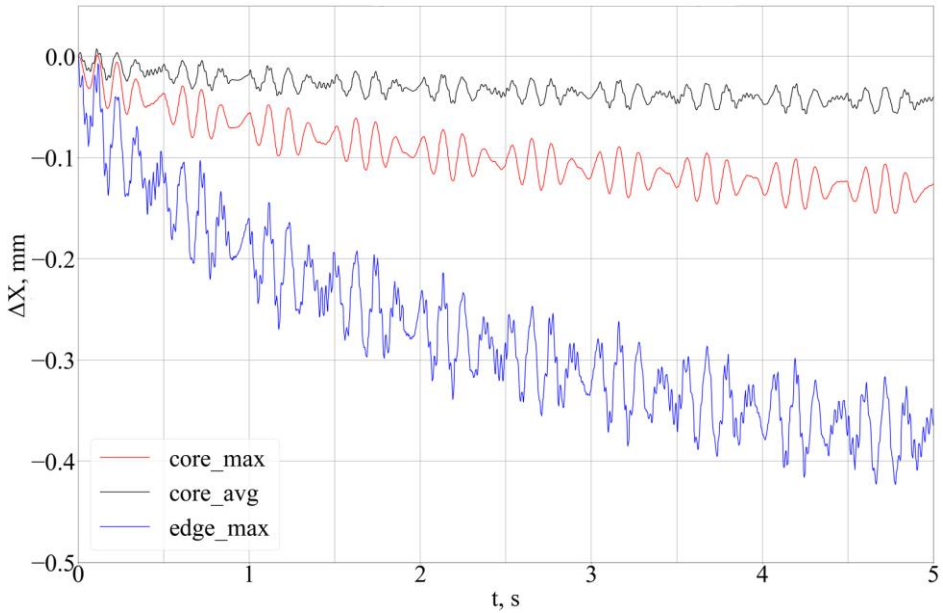
Structure of the program



Structure of the program



Thermal elasticity

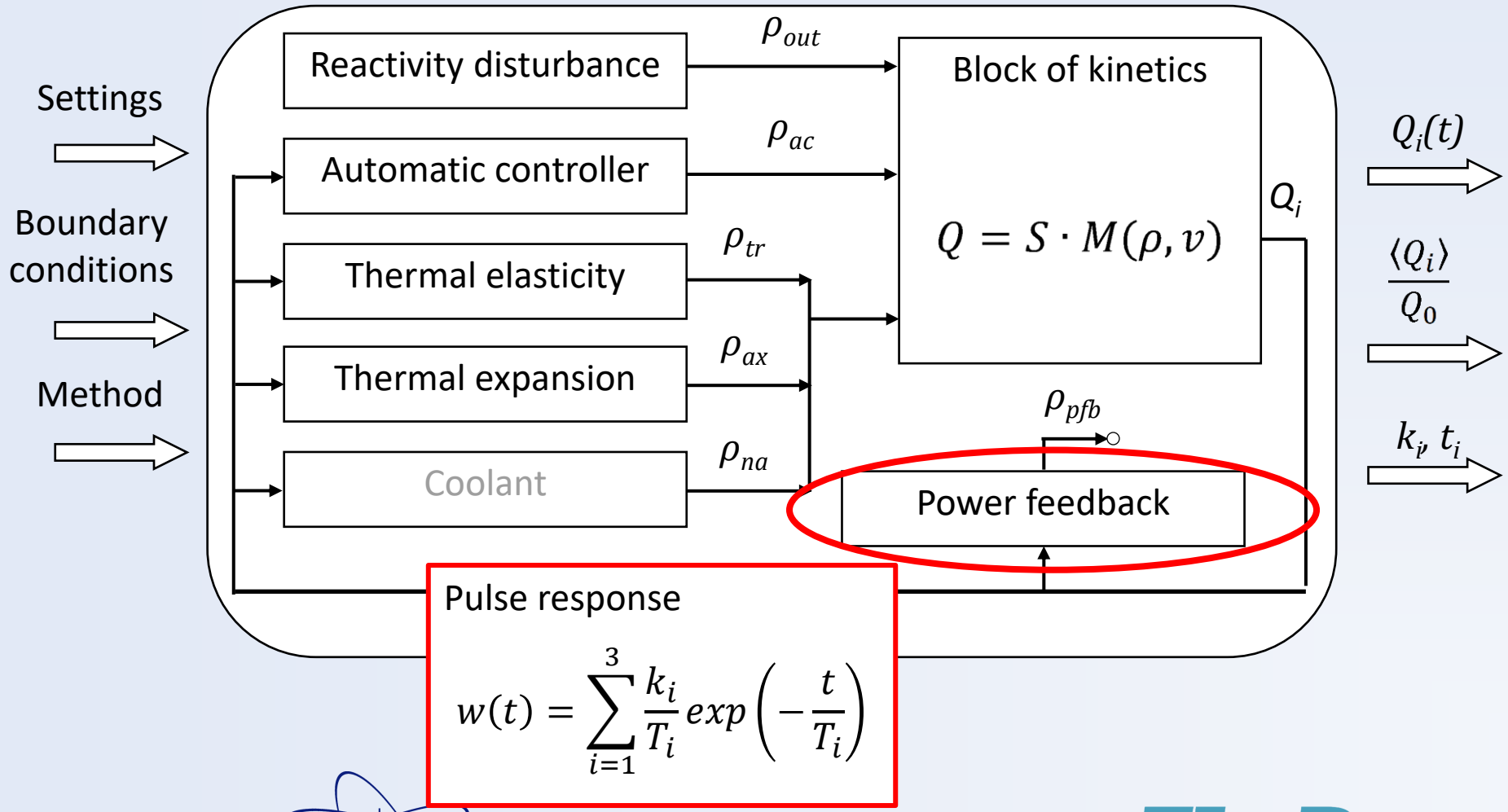


Transverse deformation of a fuel rod in the case of a free edge.

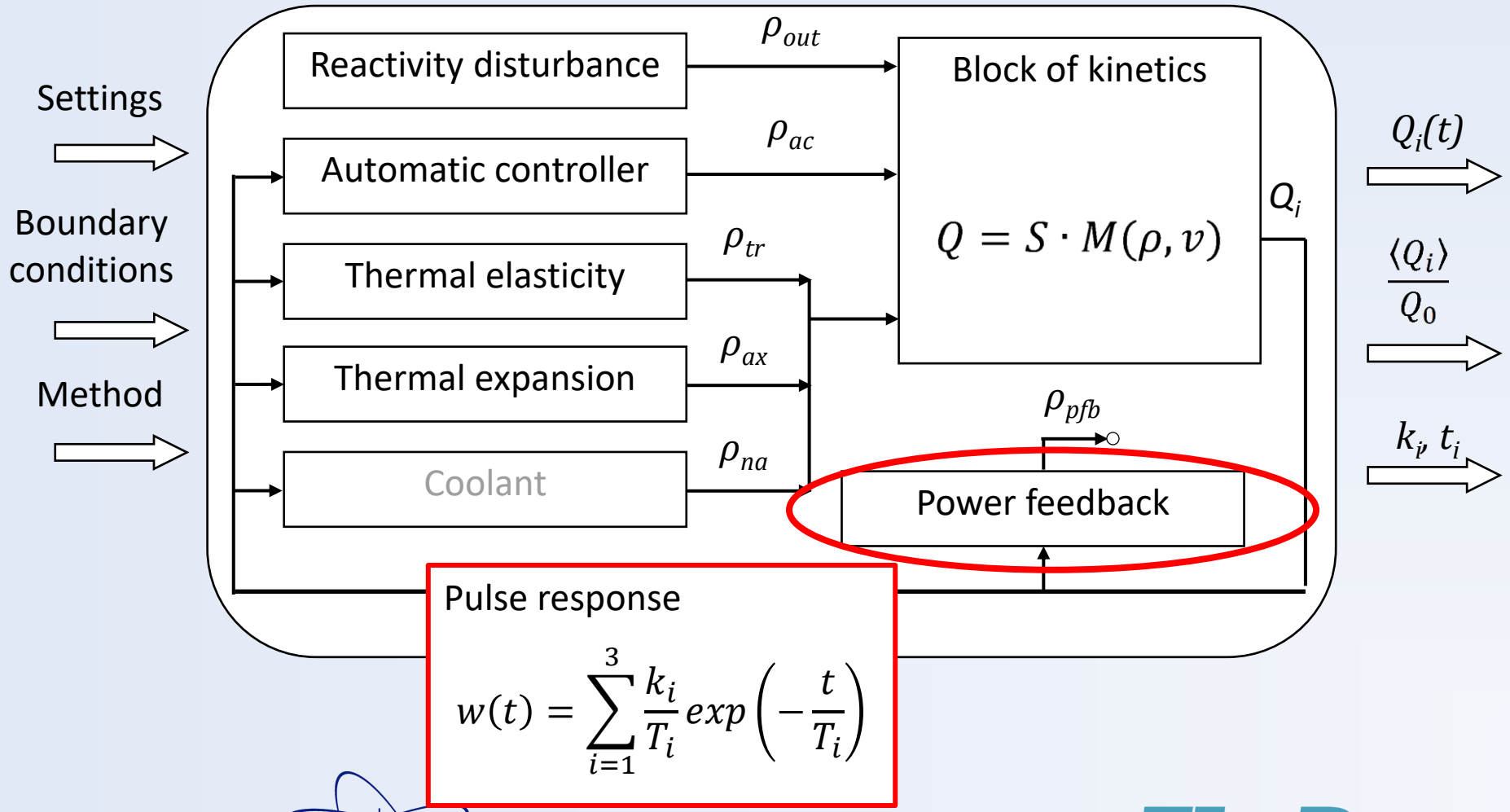
— Max displacement of fuel pellets, — Average displacement of fuel pellets,

— Max displacement of fuel rod cladding.

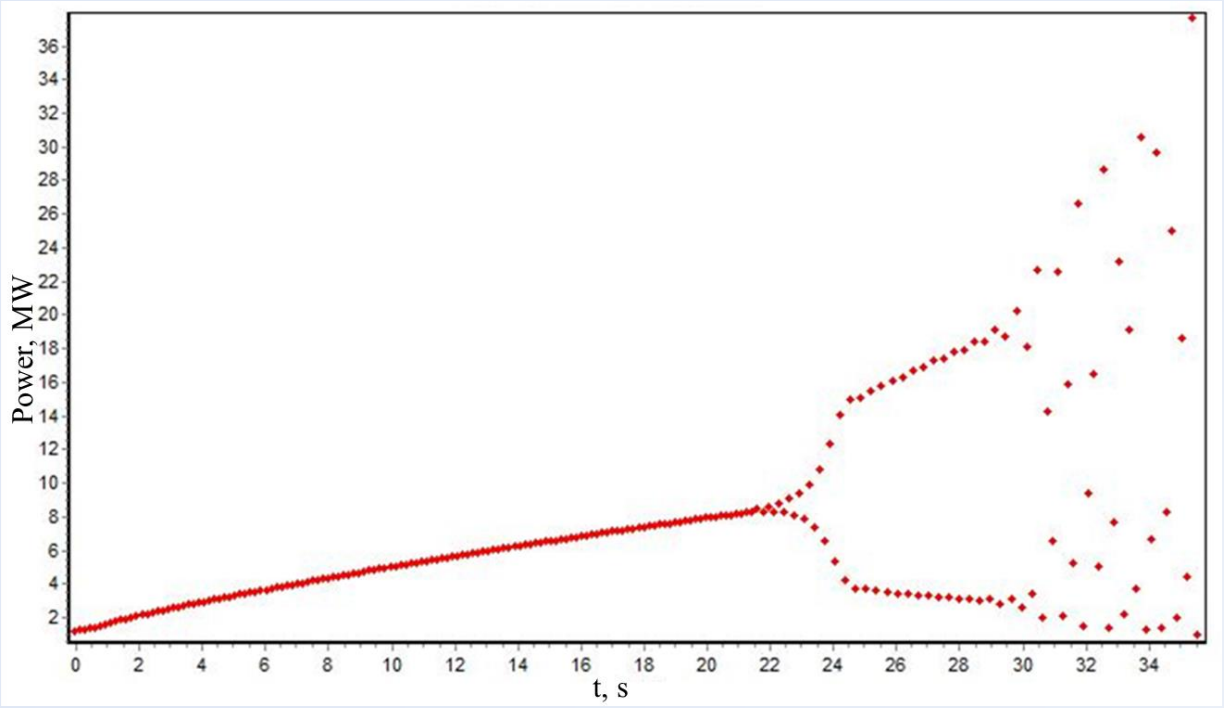
Structure of the program



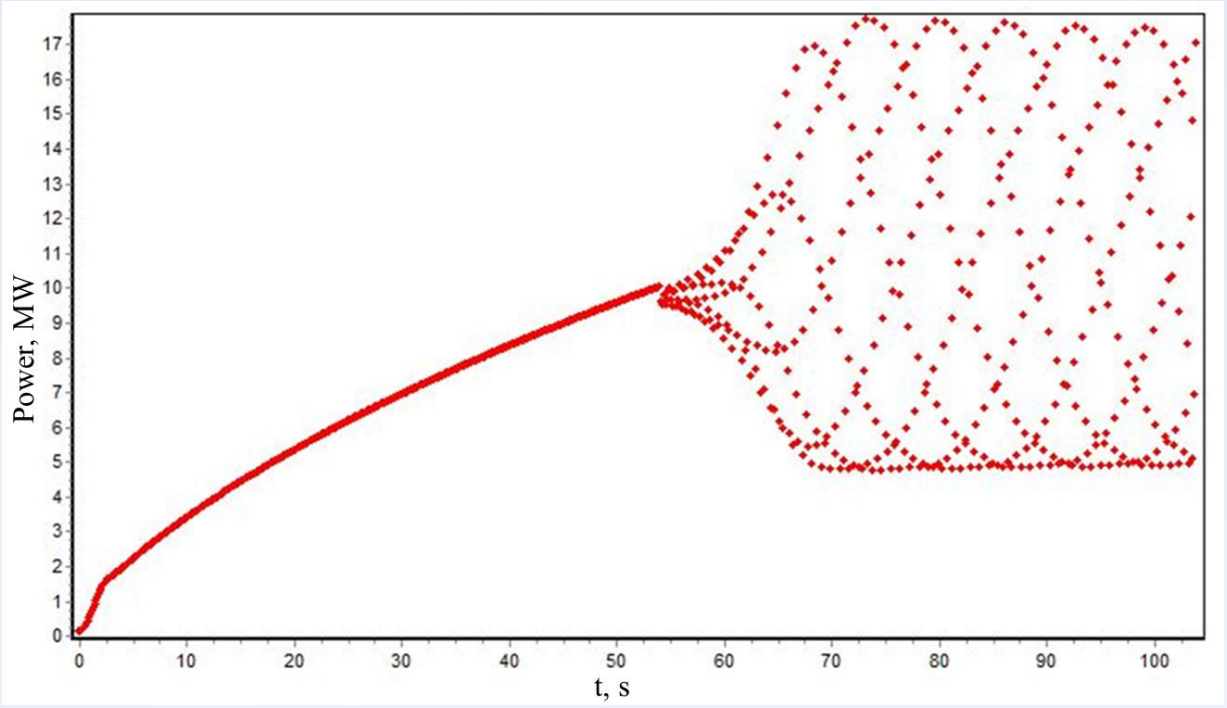
Structure of the program



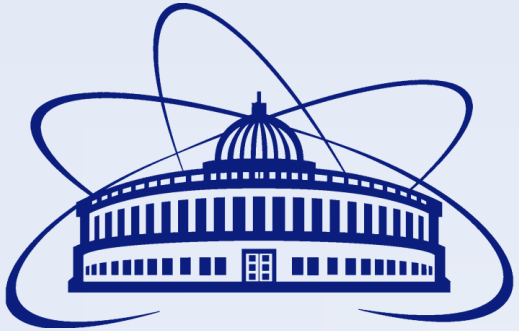
Results



Transition to stochastic dynamics due to thermal expansion of fuel (dynamic bending and disturbances disabled)



Transition to stochastic dynamics due to dynamic bending.



Thanks for your attention!

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