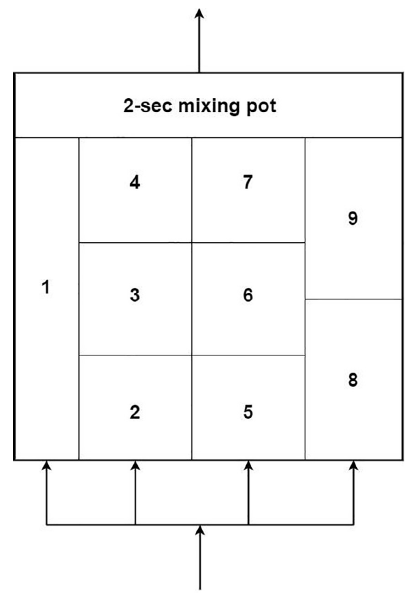
**MSRE Nine-Region Model Description**

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Except for the heat balance within the active core of MSRE, all the other parts, e.g., heat exchangers, are modelled as the same as before (one-region model calculation)

The following nine-region model is conceived:



* The inlet temperatures are the same for nodes #1,2,5 and 8
* The inlet temperatures for other nodes are inherited from the node placed below
* For each node, corresponding fuel temperatures , and graphite temperature are considered, where superscript *i* denotes the node index

Thermal balance for a certain node *i* can be expressed as:

where

Notations are defined as below:

: circulation time for fuel lump *a* (or *b*) in region ‘*i*’

: mass of fuel lump *a* (or *b*) in region ‘*i*’

: mass of graphite lump in region ‘*i*’

: Portion of heat deposited in fuel lump *a* (or *b*) in region ‘*i*’

: Fraction of power generated in the graphite transferred to each fuel lump in region ‘*i*’

: product of area and heat transfer coefficient for the fuel-graphite interface in region ‘*i*’

: Nominal power multiplied with fractional neutron density

(all the other notations are that of the convention)

Note that the following relation holds for and , where denotes the portion of heat deposited in graphite lump in region *‘i’*.

The inlet temperature is defined as:

* for *i* = 1,2,5,8
* = else

For initialization, neglect the time dependent terms, yielding 3x3 matrix with a prescribed value.

For time-dependent calculation, employ implicit Euler method, yielding 3x3 matrix:

The presence of 2-sec mixing pot should be considered, where denotes the mixing pot fuel temperature:

The above equation can be easily handled as well using the implicit Euler method. Notations and are defined as below:

where is the mass flow rate in the core, and is the flow time in the mixing pot (2sec).

Unlike the one-region model, the outlet temperature from the MSRE core is represented as , which is then transferred to the IHX with a prescribed time-lag.

All the other representation for IHX & SHX are the same as that of the one-region model:

