A distributed-parameter model is developed for a pressurized water reactor (PWR) in order to analyze the frequency behavior of the nuclear reactor. The model is built based upon the partial differential equations describing heat transfer and fluid flow in the reactor core. As a comparison, a multi-lump reactor core model with five fuel lumps and ten coolant lumps using Mann’s model is employed. The derivations of the different transfer functions in both models are also presented with emphasis on the distributed parameter. In order to contrast the two models, Bode plots of the transfer functions are generated using data from the Palo Verde Nuclear Generating Station. Further, a detailed contradistinction between these two models is presented.

From the comparison, the features of both models are presented. The distributed parameter model has the ability to offer an accurate transfer function at any location throughout the reactor core. In contrast, the multi-lump parameter model can only provide the average value in a given region (lump). Also, in the distributed parameter model only the feedback according to the specific location under study is incorporated.
into the transfer function; whereas the transfer functions derived from the multi-lump model contain the average feedback effects happening all over the reactor core.