Neutronic Parameters Evaluation for an Accelerator Driven Subcritical Reactor Designed for Nuclear Energy Generation and Nuclear Waste Transmutation

A thesis submitted as a partial fulfillment of the requirements for the degree of Master of scince in Physics

to

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To my father and my mother Words cannot express how grateful I am to my mother and father. My Parents, whose has been a source of sympathy, and for their continuous encouragement and inspiration to me.

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ABSTRACT

Abstract

In the present study, the FAst Spectrum Transmutation Experimental Facility (FASTEF) core proposed for the MYRRHA reactor in Belgium is considered and modeled using Monte Carlo N-Particle Transport Code.

The effect of changing the type of material and radius of the cylindrical target source as well as the proton beam energy on the final neutron production and the subcritical system multiplication are evaluated. Subcritical models of the investigated reactor have been numerically investigated as well. six target materials; uranium (U), lead-bismuth eutectic (LBE), tungsten (W), lead (Pb), bismuth (Bi), and copper (Cu) are used with varying target radii from 3.5 to 20 cm. The beam energy is varied from 0.2 to 2.0GeV. The present investigation is based on the numerical calculations of the subcritical multiplication factor and the external source efficiency using Monte Carlo MCNPX 2.6.0 code. The obtained results revealed that the favorable target material, radius, and beam energy can be precisely determined.