

INTISARI

ANALISIS KRITIKALITAS MODEL TERAS REAKTOR NUKLIR 200 MW_{th} BERBAHAN BAKAR LELEHAN GARAM LiF-BeF₂-ZrF₄-UF₄ MENGGUNAKAN MCNP

Oleh

Rio Rizky Rahmadani

14/364251/TK/41931

Diajukan kepada Departemen Teknik Nuklir dan Teknik Fisika Fakultas Teknik
Universitas Gadjah Mada pada tanggal 22 Agustus 2021
untuk memenuhi sebagian persyaratan untuk memperoleh derajat
Sarjana Program Studi Teknik Nuklir

INTISARI

Penelitian ini menggunakan simplifikasi reaktor MSRE berbahan bakar lelehan garam LiF-BeF₂-ZrF₄-UF₄.

Tujuan penelitian ini adalah mengetahui (1) pengaruh rasio volume bahan bakar terhadap volume moderator terhadap kritikalitas teras reaktor, (2) pengaruh rasio tinggi-diameter terhadap kritikalitas teras reaktor dan (3) pengaruh pengkayaan terhadap kritikalitas teras reaktor.

Metode penelitian ini dilakukan dengan mengubah rasio volume bahan bakar-volume moderator, rasio tinggi-diameter dan pengkayaan U-235 sebanyak masing-masing 21 variasi. Variasi tersebut kemudian disimulasikan dalam software MCNP, sehingga diperoleh koefisien kritikalitas.

Dari hasil penelitian disimpulkan (1) Rasio volume bahan bakar-volume moderator (x) berpengaruh terhadap kritikalitas (y) reaktor, melalui persamaan kuadrat $y = 1.154 + 0.3625x - 0.5999x^2$, Koefisien k_{eff} mencapai titik puncak pada rasio volume bahan bakar-volume moderator sebesar 0,3021. Pengaruh rasio volume bahan bakar-volume moderator terhadap k_{eff} adalah 80,97%. (2) Rasio tinggi-diameter (H/D) (x) berpengaruh terhadap kritikalitas (y) melalui persamaan logaritmik, $y = 0,1723\ln(x) + 1,174$. Pengaruh rasio tinggi-diameter terhadap k_{eff} adalah 95,97%. (3) Pengayaan U-235 (x) berpengaruh terhadap kritikalitas (y), melalui persamaan linear $y = 14,05x + 1,01$. Pengaruh pengayaan U-235 terhadap k_{eff} adalah 98%.

Kata kunci: Kritikalitas, Rasio Volume Moderator-Volume Bahan Bakar, Rasio Tinggi-Diameter, Pengayaan U-235

Pembimbing Utama : Dr.Ing.Ir. Sihana

Pembimbing Pendamping : Dr. Ir. Andang Widi Harto, M.T.



CRITICALITY ANALYSIS OF 200 MW_{th} NUCLEAR REACTOR CORE MODEL WITH LiF-BeF₂-ZrF₄-UF₄ MOLTEN SALT USING MCNP

by

Rio Rizky Rahmadani

14/364251/TK/41931

Submitted to the Departement of Nuclear Engineering and Engineering Physics
Faculty of Engineering Universitas Gadjah Mada on August 22, 2021
in partial fulfillment of the requirement for the Degree of
Bachelor of Engineering in Nuclear Engineering

ABSTRACT

This research uses MSRE reactor core simplification with LiF-BeF₂-ZrF₄-UF₄ molten salt fuel.

The purpose of this study is to find out (1) the effect of the ratio of the volume of fuel to the volume of the moderator on the criticality of the reactor core, (2) the effect of the height-diameter ratio on the criticality of the reactor core and (3) the effect of enrichment on the criticality of the reactor core.

The research is done by changing the ratio of the volume of the fuel-volume moderator, the ratio of height-diameter and enrichment of U-235 with 21 variations each. The variation is then simulated in MCNP software, so that the criticality is obtained.

From the results of the study concluded (1) The ratio of the volume of fuel-volume moderator (x) has an effect on the criticality (y) of the reactor, through the quadratic equation $y = 1,154 + 0,3625x - 0,5999x^2$, the k_{eff} coefficient reaches the optimal point at the ratio of the volume of fuel-volume moderator of 0.3021. The effect of the moderator-fuel volume ratio on k_{eff} is 80,97%. (2) The height-diameter ratio (H/D) (x) affects the criticality (y) through the logarithmic equation, $y = 0,1723\ln(x) + 1,174$. The effect of the height-diameter ratio to k_{eff} is 95,97%. (3) U-235 enrichment (x) affects the criticality (y), through the linear equation $y = 14,05x + 1,01$. The effect of the ratio of the volume of fuel to the volume of the moderator on k_{eff} is 98%

Keywords: Criticality, Fuel-Moderator Volume Ratio, Height-Diameter Ratio, U-235 Enrichment

Supervisor : Dr.Ing.Ir. Sihana

Co-supevisor : Dr. Ir. Andang Widi Harto, M.T.

