

Measurement of Subcriticality by Source Multiplication Method with Consideration of Higher Mode

Tsuyoshi Misawa

Research Reactor Institute, Kyoto University

Kumatori, Osaka 590-0494 Japan

Abstract

It is important to develop a method for measuring subcriticality of a system with fissile materials from a viewpoint of nuclear criticality safety, and many techniques have been applied for this purpose. Neutron source multiplication method is one of the methods for subcriticality measurement, which is simple method. However, position of both neutron detector and neutron source cannot be considered in this method and it is possible to applied only to small subcriticality measurement. To overcome these difficulty, new source multiplication method with consideration of higher mode flux was developed. In the present method, neutron flux distribution with an external neutron source in subcritical state was expanded in a series of higher mode flux, and when neutron count of detector was measured at an already-known subcritical state, other unknown subcriticality can be obtained through measuring neutron counts. Numerical simulations were carried out to demonstrate the present method by simulating a KUCA core experiment. It is found that subcriticality can be obtained accurately up to $-20\%dk/k$ by the present method, and detector position dependency in measured subcriticality was also greatly decreased compared to the ordinary source multiplication method.