U.S. DEPARTMENT OF ENERGY
NUCLEAR ENERGY RESEARCH INITIATIVE
ABSTRACT

PI: **Dmitriy Anistratov** **Proposal No.: 99-0269**

Institution: **Texas A&M University**

Collaborators: **Oregon State University, Studsvik Scandpower, Inc.**

Title: **An Innovative Reactor Analysis Methodology Based on a Quasidiffusion Nodal Core Model**

The present generation of reactor analysis methods uses few-group nodal diffusion approximations to calculate full-core eigenvalues and power distributions. The cross sections, diffusion coefficients, and discontinuity factors (collectively called "group constants") in the nodal diffusion equations are parametrized as functions of many variables, ranging from the obvious (temperature, boron concentration, etc.) to the more obscure (spectral index, moderator temperature history, etc.) . These group constants, and their variations as functions of the many variables, are calculated by assembly-level transport codes. The current methodology has two main weaknesses that this project will address. The first weakness is the diffusion approximation in the full-core calculation; this can be significantly inaccurate at interfaces between different assemblies. This project will use the nodal diffusion framework to implement nodal quasidiffusion equations, which can capture transport effects to an arbitrary degree of accuracy. The second weakness is in the parametrization of the group constants; current models do not always perform well, especially at interfaces between unlike assemblies. The project will develop a theoretical foundation for current models and use that theory to devise improved models. The new models will be extended to tabulate information that the nodal quasidiffusion equations can use to capture transport effects in full-core calculations. The proposed project is a research in the field of computational physics, reactor physics and numerical methods. According to NERI classification, this research project belongs to basic science categories, namely, computational sciences.