

THERMAL DIFFUSION AND ENVIRONMENTAL IMPACT: A CASE STUDY

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ABSTRACT

The production of electricity in nuclear power plants is one of the options for the energy supply in Brazil. One of the characteristics of this energy conversion process is the need for clean water for the cooling equipment. For this reason, the Brazilian nuclear power plant is located in the district of Angra dos Reis, in the state of Rio de Janeiro, a region with good water potential and rich biodiversity. To understand the impact of warm water discharges from the cooling fluid of the nuclear reactors in the coastal region of Angra dos Reis, the objective of this article is to present results for the model of classical advection-diffusion equation in a two-dimensional domain. The choice for the two-dimensional domain was based on the fact that the extension of the horizontal area is significantly greater than the depth. In addition, it was considered that the velocity term assumes the parabolic profile and occurs predominantly in the laminar regime in the x-axis. Due to the specific characteristics of the source relative to the global domain, the finite elements method was adopted in the discretization model. It allows to preserve the characteristics of the source, to bring it closer to the Dirac Delta mainly due to the dimensions involved. It also allows the discretization of the global domain by elements of simple geometric shape such as triangles and rectangles. Throughout this article, two different types of finite elements were used: a triangular three points element, generating test functions of first order, and a quadrilateral four points elements, generating a mixed order elements. The use of different elements is to compare the results of the geometric profiles for the dispersion of the thermal pollution and subsequently to evaluate the error introduced in each study approach.