

A MATHEMATICAL AND NUMERICAL STUDY OF A MODEL FOR AN AVASCULAR TUMOR EVOLUTION.

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Abstract. In this work, we are interested in a mathematical study of a model describing a tumor evolution. This model is based on reaction diffusion system with constant and variable diffusion coefficients. First, we show the well-posedness of the derived models using the semigroup theory, then we explore the numerical study by the use of a stable scheme based on the finite element method. The obtained numerical results are shown to be efficient and qualitatively compared to those in literature.

Keywords. Tumor Evolution, Reaction-Diffusion, Mathematical Modeling, Stability, Finite Elements.

AMS (MOS) subject classification: 92B99, 35K57, 97M60, 65N12, 65N30.

1 Introduction

Over the last century, mathematical modeling research has gained prominence across various domains, including biology and medical sciences, such as image processing, drug effects on blood flow, and the understanding of the immune defense system.

Tumor development models have become a focal point of investigation due to the high mortality associated with tumors [3], [6] and [15]. It plays a pivotal role in investigating cancer complexities and progression, offering insights that are instrumental for both diagnosis and treatment. These models provide a mathematical framework to analyse and simulate the intricate dynamics of tumor growth, considering factors such as cell proliferation, angiogenesis, and interactions with the surrounding micro environment. By capturing the underlying principles governing tumor behavior, these models contribute to our comprehension of the disease's mechanisms. Numerous systems have been proposed to characterize cancer cell proliferation, ranging from macroscopic perspectives to microscopic cell-to-cell descriptions, incorporating physical laws and environmental factors that influence tumor development, see for example [9]. Additionally, machine learning methods and theoretical computer sciences, particularly those utilizing databases [18]