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وزارة التعليم العالي والبحث العلمي
جامعة قسنطينة 1 – الإخوة منتوري
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PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH
Constantine 1 University – Frères Mentouri
Faculty of Exact Sciences

ANNONCE DE SOUTENANCE

Melle **REDOUANE Kelthoum Lina**

Soutiendra sa thèse de **Doctorat Troisième Cycle** en Mathématiques

Spécialité : « Mathématiques Appliquées »

Intitulée : « Approche numérique de problèmes d'évolution avec conditions aux limites».

D a t e : le Lundi 17 Février 2025 à 16 H0O.

L i e u : *A la salle de conférences sise au Campus AHMED HAMANI (ZERZARA) Université Constantine1 Frères Mentouri.*

Devant le jury :

	Nom et prénoms	Grade	Etablissement d'appartenance
Président	HAMEIDA ALI	Professeur	Université Constantine1, Frères Mentouri
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A b s t r a c t :

Numerous physical phenomena are governed by partial differential equations, which serve as indispensable tools across diverse fields. While some of these equations possess analytical solutions, many remain unsolved,

prompting extensive research into numerical approximation methods. Our study introduces a novel approach for numerically solving partial differential equations (PDEs) in temporal domains, integrating Galerkin-type methods with appropriate basis functions to formulate a system of ordinary differential equations over time which are discretized using higher-order finite difference schemes. In numerical solution computation, especially for non-linear models, the reliance on differential equations poses significant challenges. B-spline functions have emerged as effective tools for addressing non-linear initial/boundary value problems, given their advantageous local support properties. This research builds upon this foundation, demonstrating superior effectiveness, faster convergence, reduced storage and computational requirements, and accommodation of smaller spatial dimensions. This thesis underscores the utilization of cubic B-splines for computing numerical solutions of differential equations. Finite difference schemes discretize time derivatives, while B-spline functions interpolate spatial derivatives.

Notably, the study addresses second-order singular boundary value problems, non-linear regularized long wave equations, and non-linear integral boundary conditions associated with the heat equation. These challenges are tackled using a novel cubic B-spline collocation method, showcasing unconditional stability and numerical convergence. This thesis innovative aspect and primary contribution lie in developing a numerical scheme based on cubic B-spline functions explicitly tailored for linear and non-linear partial differential equations. Test problems are meticulously employed to validate and enhance the proposed schemes' accuracy, validity, and efficiency, advancing state-of-the-art numerical analysis methodologies.