



الجمهورية الجزائرية الديمقراطية الشعبية  
وزارة التعليم العالي والبحث العلمي  
جامعة قسنطينة 1 – الإخوة منتوري  
كلية العلوم الدقيقة



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



Conformément à la décision n° 21/DS/2026 datée du 16 Mars 2026 autorisant la soutenance d'une thèse de doctorat en Sciences, le Vice-doyennat chargé de la post-graduation, de la recherche scientifique et des relations extérieures, a n n o n c e la soutenance publique d'une thèse de doctorat en Sciences le :

**Mardi 14 Avril 2026 à 16H00**

**Lieu :** A la salle de conférences sise au Campus Ahmed Hamani (Zerzara) - Constantine 1 – Frères Mentouri

**Filière :** MATHEMATIQUES

**Spécialité :** Probabilités et Statistiques

Doctorante: **MILI Wafa**

**Sur le thème : « Contribution à l'inférence statistique dans les modèles 2D ARMA-GARCH ».**

Devant le jury d'examen :

	Nom et prénoms	Grade	Etablissement d'appartenance
<b>Présidente</b>	LEULMI Sarra	M.C.A	Université Constantine1, Frères Mentouri
<b>Directrice de thèse</b>	KHARFOUCHI Soumia	Professeure	Université Salah Boubnider Constantine 3
<b>Examineurs</b>	KIMOUCHE Karima	M.C.A	Université 20 Aout 1955 Skikda
	BOUKELOUA Mohamed	M.C.A	Ecole Nationale Polytechnique Constantine 3
	MEZHOUD Kenza Assia	M.C.A	Université Constantine 1 , Frères Mentouri
	BOUDADA Halima	M.C.A	Université Constantine 1 , Frères Mentouri

# A b s t r a c t

This thesis focuses on the study of the probabilistic structures and asymptotic properties of quasi-maximum likelihood (QML) estimators for the parameters of two classes of two-dimensional nonlinear processes: the pure GARCH model and the ARMA-GARCH model. Our approach is distinguished by minimal assumptions, enhancing the flexibility and applicability of these models to various datasets, particularly in image and signal processing. First, we establish necessary and sufficient conditions ensuring the existence and uniqueness of strictly stationary solutions for the 2D GARCH and 2D ARMA-GARCH models. These results rely on Markovian vector representations and stability criteria based on the Lyapunov exponent. Next, we carry out statistical inference within this class of models. By applying the quasi-maximum likelihood (QML) method, we propose estimators of the parameter vector that are consistent and asymptotically normal, even under misspecification of the innovation distribution.

This approach minimizes the Kullback-Leibler divergence between the true distribution and a misspecified parametric family, thereby ensuring the robustness of the estimators. A Monte Carlo simulation study was conducted to validate these theoretical results.

Finally, our work opens promising perspectives for concrete applications, notably in ultrasound image processing and in the analysis of complex spatial data, highlighting the broader implications of our research where the simultaneous consideration of nonlinearity and spatial dependence is crucial.