

# ICRAMCS 2026

THE EIGHTH EDITION OF THE INTERNATIONAL CONFERENCE ON  
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE

April 23-24-25, 2026 | Marrakech, Morocco



## The Hopf bifurcation Analysis, calibration and stabilization of an SEIR epidemic model.

### Communication Info

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#### Keywords:

SEIR epidemic model; Ordinary  
differential equations; Nonlinear  
dynamics;  
Levenberg-Marquardt method;  
Inverse problem; Chaos Control;  
Backstepping Control.

### Abstract

In this paper, we consider a SEIR epidemic model in which recruitment is assumed to be governed by a logistic function. Mathematical analysis is used to study the dynamic behavior of this model. A threshold parameter  $R_0$  is identified which governs the spread of disease, and this parameter is known as the basic reproduction number. The model has at least three equilibria, one endemic equilibrium and two disease-free equilibria. We demonstrate that the first disease-free equilibrium is always unstable and that the second disease-free equilibrium is locally asymptotically stable when the basic reproduction number  $R_0$  is strictly less than unity. Otherwise, when the  $R_0 > 1$  and by choosing the intrinsic growth rate of the population  $r$  as bifurcation parameter, we show that the system loses its stability and a Hopf bifurcation occurs. Next, trying to validate the SEIR model and estimate the parameters that minimize the error between the numerical simulations and the real experimental data, we have determine the inverse problem associated with identification and we solved it. The resulting calibrated model has parameters and returns reasonable predictions that better represent reality. Furthermore, a backtracking design is proposed to achieve stabilization of the SEIR model towards the second disease-free equilibrium point. The proposed method is a recursive scheme based on Lyapunov and provides a systematic procedure to design stabilizing controllers. The proposed controller extinguishes disease and stabilizes the chaotic motion of the system using a single control input.

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