Giresun University, Faculty of Arts and Sciences

Department of Mathematics

Online Colloquiums – 3

Virtual Invited Speaker

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ResearchGate Profile

Moderator

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: *Global Periodic Behavior in an HPA Axis Model with Time-Dependent Stress Input*

: *November 20, 2025*

: *17.00 (Istanbul Time), 09.00 (Eastern Time)*

: https://teams.live.com/meet/9353216477253?p=GeKxX6KkwoDia1mvpJ

: In this talk, we present a new hypothalamic–pituitary–adrenal(HPA) axis model that incorporates stress as an explicit, time-dependent forcing term alongside circadian modulation of hormone secretion. We formulate a nonlinear ODE system for CRH, ACTH, and cortisol that includes positive and negative feedback via Michaelis–Menten interactions. Using coincidence degree theory, we derive structural conditions ensuring the existence of at least one positive ω-periodic solution and prove that it becomes a global attractor under boundedness and uniform persistence. In the absence of stress, the model reproduces intrinsic ultradian and circadian oscillations. When an individualized trigonometric stress function is introduced, patient-specific fits improve markedly—without altering internal physiological parameters.

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