



# Nonlinear Analysis for Human Movement Variability

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**Nonlinear Analysis for Human Movement Variability** From CRC Press

## *How Does the Body's Motor Control System Deal with Repetition?*

While the presence of nonlinear dynamics can be explained and understood, it is difficult to be measured. A study of human movement variability with a focus on nonlinear dynamics, **Nonlinear Analysis for Human Movement Variability**, examines the characteristics of human movement within this framework, explores human movement in repetition, and explains how and why we analyze human movement data. It takes an in-depth look into the nonlinear dynamics of systems within and around us, investigates the temporal structure of variability, and discusses the properties of chaos and fractals as they relate to human movement.

Providing a foundation for the use of nonlinear analysis and the study of movement variability in practice, the book describes the nonlinear dynamical features found in complex biological and physical systems, and introduces key concepts that help determine and identify patterns within the fluctuations of data that are repeated over time. It presents commonly used methods and novel approaches to movement analysis that reveal intriguing properties of the motor control system and introduce new ways of thinking about variability, adaptability, health, and motor learning.

In addition, this text:

- Demonstrates how nonlinear measures can be used in a variety of different tasks and populations
- Presents a wide variety of nonlinear tools such as the Lyapunov exponent, surrogation, entropy, and fractal analysis
- Includes examples from research on how nonlinear analysis can be used to understand real-world applications
- Provides numerous case studies in postural control, gait, motor control, and motor development

Nonlinear Analysis for Human Movement Variability advances the field of human movement variability research by dissecting human movement and

studying the role of movement variability. The book proposes new ways to use nonlinear analysis and investigate the temporal structure of variability, and enables engineers, movement scientists, clinicians, and those in related disciplines to effectively apply nonlinear analysis in practice.

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### Editorial Review

#### Review

"This is an excellent book not only for those interested in human movements but for those interested in nonlinear phenomena more generally."-Nonlinear Dynamics, Psychology, and Life Sciences Journal, October, 2016

"In summary, *Nonlinear analysis of human movement variability* is a welcome addition for students and researchers of human movement science who are sure to appreciate a new introduction and reference work to this intriguing and important emerging research area"- Journal of Biomechanics, September 2016.

#### About the Author

**Dr. Nick Stergiou** is the Distinguished Community Research Chair in Biomechanics, Professor, and Director of the Biomechanics Research Building at the University of Nebraska Omaha. He is also a Professor in the Department of Environmental, Agricultural, and Occupational Health of the College of Public Health at the University of Nebraska Medical Center. His research focuses on understanding variability inherent in human movement, and he recently founded the first ever Center for Research in Human Movement Variability within the Department of Biomechanics at the University of Nebraska Omaha. Dr. Stergiou is an international authority in the study of nonlinear dynamics and has published more than 200 peer-reviewed articles.

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##### **Laura Crabtree:**

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