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Paper

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Undergraduate Engineering Curriculum Route to Development of Nonlinear Science in Graduate Studies

Complex systems and their behavior are studied due to their importance in theoretical and practical advantages in engineering and science. Complexity of system's behavior calls for new methods and concepts other than those traditionally represented in engineering curriculum. Regardless to level of course that nonlinear dynamical systems and chaos is introduced to students, a new point of view is required for succession in nonlinear dynamical systems and chaos. However due to existence of several prerequisites and level of difficulty and degree of applicability, nonlinear dynamical systems and chaos are only welcomed to engineering curriculum in graduate studies. In this paper we are concerned on development of undergraduate engineering curriculum in order to cover necessary prerequisites for graduate of nonlinear dynamical systems and chaos in engineering colleges. Ability of current students those are educated in traditional educational system against nonlinear dynamical systems concepts and necessities are evaluated during a survey. In this survey a questionnaire is delivered in the classroom between students. The students have chosen from those completed a course in "Ordinary differential equations" and having a course in "Engineering Mathematics". Questions are designed to evaluate not only the mastery on traditionally represented section of nonlinear dynamical system's prerequisites, but also mean awareness of not traditionally treated prerequisites of nonlinear dynamical systems. Furthermore; concentration of traditional curriculum on well-known aspects of initial value problems are also considered. Extracted results are, then, evaluated and reported in a statistical approach. Qualitative analysis of ordinary differential equations and methods of bringing it to undergraduate engineering curriculums are considered. Concept of dynamical system and distinction between linear and nonlinear dynamical systems, concept of attractor and geometrical interpretation of attractors as well as state space are considered for introducing in undergraduate engineering curriculum. Advantages and difficulties of this introduction and the way that suggest to be used in this introduction are investigated. Method of introduction and the balance between mathematically rigorous materials and physically important ones are led to suggestion for structure and materials of being used references in undergraduate engineering curriculum.