Indian Journal of Mathematics

Volume 64, No. 1, 2022

CONTENTS

Abstract: Higher precision efficient computation of period 1 relaxation oscillations of strongly nonlinear and singularly perturbed Rayleigh equations with external periodic forcing is presented. The computations are performed in the context of conventional renormalization group method (RGM). We demonstrate that although a slight homotopically modified RGM could generate approximate periodic orbits that agree qualitatively with the exact orbits, the method, nevertheless, fails miserably to reduce the large quantitative disagreement between the theoretically computed results with that of exact numerical orbits. In the second part of the work we present a novel asymptotic analysis incorporating SL(2,R) invariant nonlinear deformation of slower time scales, $t_n = \varepsilon^n t$, $n \longrightarrow \infty$, $\varepsilon < 1$, for asymptotic late time t, to a nonlinear time $T_n = t_n \sigma(t_n)$, where the deformation factor $\sigma(t_n) > 0$ respects some well defined SL(2,R) constraints. Motivations and detailed applications of such nonlinear asymptotic structures are explained in performing very high accuracy ($> 98\%$) computations of relaxation orbits. Existence of an interesting condensation and rarefaction phenomenon in connection with dynamically adjustable scales in the context of a slow-fast dynamical system is explained and verified numerically.

Abstract: In the present paper, we establish a new weighted integral identity, through it we elaborate some new weighted Ostrowski type inequalities for Hölder continuous functions. Applications to special means are also given.

Abstract: The purpose of this paper is to establish the existence of solutions for nonlocal fractional boundary value problem on an infinite interval. By using the fixed-point theorem, sufficient conditions are obtained that guarantee the existence of at least one solution. At the end, an example is presented to illustrate the main results.

Abstract: A subset J is a (2-d-) kernel of a graph if J is independent and 2-dominating simultaneously. In this paper, we study the relation between the existence of a (2-d-) kernel and parameters $\alpha(G)$ and $\gamma_2(G)$. We show that the equality $\gamma_2(G) = \alpha(G)$ is not equivalent to the existence of a (2-d-) kernel. Moreover, we give a complete characterization of trees with (2-d-) kernel using partitions of a tree into edge-disjoint stars.

Abstract: In the article, we establish several new Simpson type inequalities for the functions whose absolute value of the first derivative is preinvex via the Riemann-Liouville integral operator.

Abstract: This research note deals with the evaluation of some generalized beta-type integrals involving the multi-index Mittag-Leffler function $E_{(\epsilon_i),(\omega_i)}(z)$. Further, we derive a new family of beta-type integrals involving the product of a multi-index Mittag-Leffler function and a generating function of two variables. Some concluding remarks regarding our present investigation are briefly discussed in the last section.

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