

On Direct Transformation Approach to Asymptotical Analytical Solutions of Perturbed Partial Differential Equation

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Abstract: In this article, we will derive an equality, where the Taylor series expansion around $\varepsilon=0$ for any asymptotical analytical solution of the perturbed partial differential equation (PDE) with perturbing parameter ε must be admitted. By making use of the equality, we may obtain a transformation, which directly map the analytical solutions of a given unperturbed PDE to the asymptotical analytical solutions of the corresponding perturbed one. The notion of Lie-Bäcklund symmetries is introduced in order to obtain more transformations. Hence, we can directly create more transformations in virtue of known Lie-Bäcklund symmetries and recursion operators of corresponding unperturbed equation. The perturbed Burgers equation and the perturbed Korteweg-de Vries (KdV) equation are used as examples.

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Key words: perturbed partial differential equation, asymptotical analytical solution, Lie-Bäcklund symmetries

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