Finite solutions of the N. Kowalewski equations for motion of a rigid body about a fixed point

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Abstract

By applying the general methods and algorithms of Power Geometry [1] we obtain new possibilities for searching of particular solutions to classical problems of the rigid body dynamics. We refer to the papers of A.D. Bruno and V.V. Lunev as successful examples where methods of Power Geometry were used for finding of families of power–logarithmic expansions of solutions to the N. Kowalewski differential equations [2], which describe motion of a heavy rigid body with a fixed point in the case $B \neq C$, $x_0 \neq 0$, $y_0 = z_0 = 0$.

The exact finite solutions (which can be presented via finite sums of rational powers of the independent variable p) were comprehensively studied in [3]. We develop these investigations and discuss computer algorithms for finding of the truncated systems of the N. Kowalewski equations, demonstrate the graphical capabilities of the Maple packages for construction and visualization of polyhedrons and normal cones of such systems, give examples of the numerical calculations, consider algorithms for analytical computations of coefficients of power expansions.

[1] *Bruno A.D.* Power Geometry in Algebraic and Differential Equations, Elsevier Science, Amsterdam, 2000, 385 p.

[2] *Kowalewski N.* Eine neue partikuläre Lösung der Differenzialgleichungen der Bewegung eines schweren starren Körpers um einen festen Punkt// Math. Ann., 65 (1908) 528–537.

[3] *Bruno A.D., Gashenenko I.N.* Finite solutions of the N. Kowalewski equations// Mechanics of Rigid Body, IAMM NASU, 35 (2005) 31–37 (in Russian).