New results for Euler-Poisson equations

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Abstract

We give a survey of recent results on solutions to Euler-Poisson equations describing the motion of a rigid body with a fixed point. These results are obtained with the help of Power Geometry.

1. Under some restrictions on parameters, the system of six Euler-Poisson equations is reduced to the system of two N. Kovalevski equations. We found all power-logarithmic expansions of solutions to N. Kovalevski equations. They form 24 families.

2. For N. Kovalevski equations, we found all exact solutions that are finite sums of powers of the independent variable with complex coefficients. They form 12 families, 7 of which were found earlier (Goryachev, Chaplygin, Steklov, N. Kovalevski, Applrott, Gorr). All new solutions are complex.

3. Under an additional restriction $A = B$, the Euler-Poisson system contains only one parameter and has four two-parametric families of stationary solutions. In these families we isolate 28 sets of stationary solutions near which the system is locally integrable; 10 of them are real. We also found new families of periodic solutions close to the stationary ones.

4. For the case 3 of Euler-Poisson system, we found complex families of infinitely remote stationary points near which the system is locally integrable.