Finding New Integrals of the Algaba System

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Abstract. We consider an autonomous system of ordinary differential equations, which is resolved with respect to derivatives. To study local integrability of the system near a degenerate stationary point, we use an approach based on Power Geometry[2] and on the computation of the resonant normal form[3, 4]. For the partial non Hamilton 5-parameter case of concrete planar system[1], we found the complete set of necessary conditions on parameters of the system for which the system is locally integrable near a degenerate stationary point. These sets of parameters, satisfying the conditions, consist of 4 two-parameter subsets in this 5-parameter space. The first integral of motion corresponds of each such subset[5]. But along the hyper plane $b^2 = 2/3$ there can exist additional such subsets[6]. We have found two more first integrals of motion.

Acknowledgements

This work was supported by grant NSh-7989.2016.2 of the President of Russian Federation and by the Ministry of Education and Science of the Russian Federation (the Agreement number 02.a03.21.0008).

References

[1] A. Algaba, E. Gamero, C. Garcia, The integrability problem for a class of planar systems, Nonlinearity **22** (2009) 395–420

[2] A.D. Bruno, Power Geometry in Algebraic and Differential Equations, Fizmatlit, Moscow, 1998 (Russian) = Elsevier Science, Amsterdam, 2000 (English)

[3] A.D. Bruno, Local Methods in Nonlinear Differential Equations, Nauka, Moscow, 1979 (Russian) = Springer-Verlag, Berlin, 1989 (English)

[4] V.F. Edneral, On algorithm of the normal form building, in: Ganzha et al. (Eds.) Proceedings of the CASC 2007, Springer-Verlag series: LNCS 4770 (2007) 134–142

[5] V. F. Edneral and V. G. Romanovsky, Calculation of First Integrals of a Two Dimensional ODE System near a Degenerate Stationary Point by Computer Algebra Tools, Programming and Computer Software, **37** 2 (2011) 99–103

[6] Alexander D. Bruno, Victor F. Edneral, Possibility of Additional Solutions of the Degenerate System Near Double Degeneration at the Special Value of the Parameter, in V.P.Gerdt et.al. (Eds.) Proceedings the CASC 2013, Springer-Verlag series: LNCS 8136 (2013) 75–87

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