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Mechanical oscillators with dampers defined by implicit constitutive relations

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Abstract: We study the vibrations of lumped parameter systems, the spring being defined by the classical linear constitutive relationship between the spring force and the elongation while the dashpot is described by a general implicit relationship between the damping force and the velocity. We prove global existence of solutions for the governing equations, and discuss conditions that the implicit relation satisfies that are sufficient for the uniqueness of solutions. We also present some counterexamples to the uniqueness when these conditions are not met.

Keywords: lumped parameter systems; differential-algebraic equations; Coulomb's friction; uniqueness of solutions

AMS Subject Classification: 34A09, 70F40, 34K32

REFERENCES

- [1] Darbha S., Nakshatrala K., Rajagopal K.R., *On the vibrations of lumped parameter systems governed by differential algebraic systems*, J. Franklin I. **347** (2010), 87–101.
- [2] Rajagopal K.R., *A generalized framework for studying the vibrations of lumped parameter systems*, Mech. Res. Commun. **17** (2010), 463–466.
- [3] Pražák D., Rajagopal K.R., *Mechanical oscillators described by a system of differential-algebraic equations*, Appl. Math. **57** (2012), no. 2, 129–142.
- [4] Meirovitch L., *Elements of Vibration Analysis*, second edition, McGraw-Hill, New York, 1986.
- [5] Vrabie I.I., *Differential Equations. An Introduction to Basic Concepts, Results and Applications*, World Scientific Publishing Co. Inc., River Edge, NJ, 2004.
- [6] Granas A., Dugundji J., *Fixed Point Theory*, Springer Monographs in Mathematics, Springer, New York, 2003.
- [7] Francfort G., Murat F., Tartar L., *Monotone operators in divergence form with x -dependent multivalued graphs*, Boll. Unione Mat. Ital. Sez. B Artic. Ric. Mat. **7** (2004), no. 1, 23–59.