

## BOUNDARY VALUE PROBLEM FOR CAPUTO-HADAMARD FRACTIONAL DIFFERENTIAL EQUATIONS

Yacine Arioua and Nouredine Benhamidouche

**Abstract.** The aim of this work is to study the existence and uniqueness solutions for boundary value problem of nonlinear fractional differential equations with Caputo-Hadamard derivative in bounded domain. We used the standard and Krasnoselskii's fixed point theorems. Some new results of existence and uniqueness solutions for Caputo-Hadamard fractional equations are obtained.

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### References

- [1] B. Ahmad and S.K. Ntouyas, *On Hadamard fractional integro-differential boundary value problems*, J. Appl. Math. Comput **2015** (2015). [Zbl 1328.34006](#).
- [2] B. Ahmad and S.K. Ntouyas, *Initial value problems of fractional order Hadamard-type functional differential equations*, Electron. J. Differ. Equ. **2015** (2015), 77. [Zbl 1320.34109](#).
- [3] B. Ahmad and S.K. Ntouyas, *A fully Hadamard type integral boundary value problem of a coupled system of fractional differential equations*, Fract. Calc. Appl. Anal. *17* (2014), 348-360. [MR3181059](#).
- [4] Alsaedi et al, *Nonlinear Hadamard fractional differential equations with Hadamard type nonlocal non-conserved conditions*, Advances in Difference Equations **2015** (2015),285. [Zbl 1351.34003](#).
- [5] M. Benchohra, S. Hamani and S.K. Ntouyas, *Boundary value problems for differential equations with fractional order*, Surveys in Mathematics and its Applications vol, **3** (2008), 1-12. [MR2532767](#). [Zbl 1157.26301](#).

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- [6] PL. Butzer, A.A. Kilbas and J.J. Trujillo, *Compositions of Hadamard-type fractional integration operators and the semigroup property*, J. Math. Anal. Appl. **269** (2002), 387-400. [Zbl 1027.26004](#).
- [7] K. Diethelm, *The Analysis of Fractional Differential Equations*, Springer Berlin, 2010. <http://dx.doi.org/10.1007/978-3-642-14574-2>.
- [8] Gambo et al, *On Caputo modification of the Hadamard fractional derivatives*, Adv. Difference Equ. **2014** (2014), Paper No. 10, 12 p. [Zbl 1343.26002](#).
- [9] A. Granas and J. Dugundji, *Fixed Point Theory*, Springer, New York, 2003. [MR1987179](#).
- [10] J. Hadamard, *Essai sur l'étude des fonctions données par leur développement de Taylor*, J. Math. Pures Appl. **8** (1892), 101-186. [MR2005999](#).
- [11] F. Jarad, D. Baleanu and A. Abdeljawad, *Caputo-type modification of the Hadamard fractional derivatives*, Adv. Differ. Equ. **2012** (2012), 142. [Zbl 1346.26002](#).
- [12] A.A. Kilbas, H.H. Srivastava and J.J. Trujillo, *Theory and Applications of Fractional Differential Equations*, Elsevier Science B.V. Amsterdam, 2006. [MR2218073\(2007a:34002\)](#). [Zbl 1092.45003](#).
- [13] A. A. Kilbas and A. A. Titouira, *Nonlinear differential equations with Marchaud-Hadamard-type fractional derivative in the weighted space of summable functions*, Math. Model. Anal. **12** (3) (2007), 343–356. [Zbl 1132.26314](#).
- [14] A. A. Kilbas, *Hadamard-type fractional calculus*, J. Korean Math. Soc. **38** (2001), 1191–1204 . [MR1858760](#). [Zbl 1018.26003](#).
- [15] M.A. Krasnoselskii, *Two remarks on the method of successive approximations*, Uspekhi Mat. Nauk **10** (1955), 123–127.
- [16] F. Mainardi, “Fractional calculus: some basic problems in continuum and statistical mechanics” in *Fractals and Fractional Calculus in Continuum Mechanics*, Vol. **378** of CISM Courses and Lectures, pp. 291–348, Springer, Vienna, Austria, 1997. [MR1611587\(99f:26010\)](#).
- [17] LI. Mengmeng and W. Jinrong, *Existence of local and global solutions for Hadamard fractional differential equations*, Electron. J. Differ. Equ, Vol. **2015** (2015), No. 166, pp. 1-8. [Zbl 1321.26014](#).
- [18] I. Podlubny, *Fractional Differential Equations*, Academic Press, San Diego, 1999. [MR1926477\(2001m:22005\)](#). [Zbl 0924.34008](#).

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- [19] S. G. Samko, A.A. Kilbas and O.I. Marichev, *Fractional Integrals and Derivatives Theory and Applications*, Gordon and Breach Science Publishers, Switzerland, 1993. [MR1347689\(96d:26012\)](#). [Zbl 0818.26003](#).
- [20] Thiramanus et al, *Positive solutions for Hadamard fractional differential equations on infinite domain*, Adv. Difference Equ. **2016** (2016), Paper No. 83, 18 p. [Zbl 1348.34025](#).

Arioua Yacine

Laboratory for Pure and Applied Mathematics, University of M'sila, Bp 166 M'sila, 28000, Algeria.

e-mail: [ariouayacine@ymail.com](mailto:ariouayacine@ymail.com)

Benhamidouche Nouredine

Laboratory for Pure and Applied Mathematics, University of M'sila, Bp 166 M'sila, 28000, Algeria.

e-mail: [benhamidouche@yahoo.fr](mailto:benhamidouche@yahoo.fr)

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