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On the Ulam stability of a class of Banach space valued linear differential equations of second order. (English) Zbl 1417.34141

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Summary: Let E be a complex Banach space. We prove the Ulam stability of a class of Banach space valued second order linear differential equations $p(x)y''(x)+q(x)y'(x)+\lambda y(x)=0$, where $p\in C^1[I,\mathbb{R}^+]$, $q\in C[I,\mathbb{R}]$ with $p'(x)=2q(x)$ for each $x\in I$; I denotes an open interval in $\mathbb{R}$, λ is a fixed positive real number. Moreover, we also provide some applications of our results.

MSC:

34G10 Linear differential equations in abstract spaces
34D20 Stability of solutions to ordinary differential equations

Keywords:

Ulam stability; linear differential equation; Chebyshev differential equation; Banach space

Full Text: DOI

References:

[1] Ulam SM: Problems in Modern Mathematics. Wiley, New York; 1960.

[2] Hyers DH: On the stability of the linear functional equation.Proc. Natl. Acad. Sci. USA 1941, 27:222-224. · Zbl 0061.26403

[3] Rassias TM: On the stability of the linear mapping in Banach spaces.Proc. Am. Math. Soc. 1978, 72:297-300. · Zbl 0398.47040

[4] Jung SM: Hyers-Ulam-Rassias Stability of Functional Equations in Nonlinear Analysis. Springer, Berlin; 2011. · Zbl 1221.39038

[5] Rassias TM: On the stability of functional equations and a problem of Ulam.Acta Appl. Math. 2000, 62:23-130. · Zbl 0981.39014

[6] Obloza M: Hyers stability of the linear differential equation.Rocznik Nauk.-Dydakt. Prace Mat. 1993, 13:259-270. · Zbl 0964.34514

[7] Alsina C, Ger R: On some inequalities and stability results related to the exponential function.J. Inequal. Appl. 1998, 2:373-380. · Zbl 0918.39009

[8] Miura T, Takahasi SE, Choda H: On the Hyers-Ulam stability of real continuous function valued differentiable map.Tokyo J. Math. 2001, 24:467-476. · Zbl 1002.39039

[9] Miura T: On the Hyers-Ulam stability of a differentiable map.Sci. Math. Jpn. 2002, 55:17-24. · Zbl 1025.47041

[10] Takahasi SE, Miura T, Miyajima S:On the Hyers-Ulam stability of the Banach space-valued differential equation[InlineEquation not available: see fulltext.]. Bull. Korean Math. Soc. 2002, 39:309-315. · Zbl 1011.34046

[11] Abdollahpour MR, Najati A: Stability of linear differential equations of third order.Appl. Math. Lett. 2011, 24:1827-1830. · Zbl 1235.34162

[12] Cîmpean DS, Popa D: On the stability of the linear differential equation of higher order with constant coefficients.Appl. Math. Comput. 2010, 217:4141-4146. · Zbl 1211.34065

[13] Jung SM: Hyers-Ulam stability of linear differential equations of first order.Appl. Math. Lett. 2004, 17:1135-1140. · Zbl 1061.34039

[14] Jung SM: Hyers-Ulam stability of linear differential equations of first order (II).Appl. Math. Lett. 2006, 19:854-858. · Zbl 1125.34328

[15] Jung SM: Hyers-Ulam stability of linear differential equations of first order (III).J. Math. Anal. Appl. 2005, 311:139-146. · Zbl 1087.34534

[16] Li Y, Shen Y: Hyers-Ulam stability of linear differential equations of second order.Appl. Math. Lett. 2010, 23:306-309. · Zbl 1188.34069

[17] Miura T, Miyajima S, Takahasi SE: A characterization of Hyers-Ulam stability of first order linear differential operators.J. Math. Anal. Appl. 2003, 286:136-146. · Zbl 1045.47037

[18] Popa D, Raşa I: On the Hyers-Ulam stability of the linear differential equation.J. Math. Anal. Appl. 2011, 381:530-537. · Zbl 1222.34069

[19] Popa D, Raşa I: Hyers-Ulam stability of the linear differential operator with non-constant coefficients.Appl. Math. Comput. 2012, 219:1562-1568. · Zbl 1368.34075

[20] Takahasi SE, Takagi H, Miura T, Miyajima S: The Hyers-Ulam stability constants of first order linear differential operators.J. Math. Anal. Appl. 2004, 296:403-409. · Zbl 1074.47022

[21] Jung SM, Kim B: Chebyshev's differential equation and its Hyers-Ulam stability.Differ. Equ. Appl. 2009, 1:199-207. · Zbl 1181.34013

[22] Jung, SM; Rassias, TM, Approximation of analytic functions by Chebyshev functions, No. 2011 (2011)

[23] Miura T, Yakahasi SE, Hayata T, Tanahashi K: Stability of the Banach space valued Chebyshev differential equation.Appl. Math. Lett. 2012, 25:1976-1979. · Zbl 1257.34043