

## NEW RESULT OF EXISTENCE OF PERIODIC SOLUTION FOR A HOPFIELD NEURAL NETWORKS WITH NEUTRAL TIME-VARYING DELAYS

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**Abstract.** In this paper, a Hopfield neural network with neutral time-varying delays is investigated by using the continuation theorem of Mawhin's coincidence degree theory and some analysis technique. Without assuming the continuous differentiability of time-varying delays, sufficient conditions for the existence of the periodic solutions are given. The result of this paper is new and extends previous known result.

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### References

- [1] C. Bai, *Global exponential stability and existence of periodic solution of Cohen-Grossberg type neural networks with delays and impulses*, Nonlinear Analysis: Real World Applications **9**(2008), 747-761. [MR2392372](#) (2009a:34122). [Zbl 1151.34062](#).
- [2] J. Cao, *New results concerning exponential stability and periodic solutions of delayed cellular neural networks*, Phys. Lett. A **307**(2003), 136-147. [MR1974596](#)(2004a:62176). [Zbl 1006.68107](#).
- [3] S. Guo, L. Huang, *Periodic oscillation for a class of neural networks with variable coefficients*, Nonlinear Anal. Real World Appl. **6** (2005), 545-561. [MR2129564](#)(2006h:34139). [Zbl 1080.34051](#).
- [4] Y. Li, *Existence and stability of periodic solutions for Cohen-Grossberg neural networks with multiple delays*, Chaos, Solotons & Fractals, **20**(2004), 459-466. [MR2024869](#)(2004i:34184). [Zbl 1048.34118](#).

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- [5] B. Liu, L. Huang, *Existence and exponential stability of periodic solutions for cellular neural networks with time-varying delays*, Phys. Lett. A **349**(2006), 474-483. [Zbl 1171.82329](#).
- [6] Z. Liu, L. Liao, *Existence and global exponential stability of periodic solution of cellular neural networks with time-varying delays*, J. Math. Anal. Appl. **290** (2004), 247-262. [MR2032238\(2004j:34161\)](#). [Zbl 1055.34135](#).
- [7] J.H. Park, O.M. Kwon, Lee, S. M, *LMI optimization approach on stability for delayed neural networks of neutral-type*, Appl. Math. Comput. **196** (2008), 236-244. [MR2382607](#). [Zbl 1157.34056](#).
- [8] S. Xu, J. Lam, D.W.C. Ho, Y. Zou, *Delay-dependent exponential stability for a class of neural networks with time delays*, J. Comput. Appl. Math. **183** (2005), 16-28. [MR2156097\(2006d:34171\)](#). [Zbl 1097.34057](#).
- [9] C. Bai, *Global stability of almost periodic solutions of Hopfield neural networks with neutral time-varying delays*, Appl. Math. Comput. **203** (2008), 72-79. [MR2451540](#). [Zbl 1173.34344](#).
- [10] O.M. Kwon, J.H. Park, S.M. Lee, *On stability criteria for uncertain delay-differential systems of neutral type with time-varying delays*, Appl. Math. Comput. **197** (2008), 864-873. [MR2400710](#). [Zbl 1144.34052](#).
- [11] Z. Gui, W. Ge, X. Yang, *Periodic oscillation for a Hopfield neural networks with neutral delays*, Phys. Lett. A **364** (2007), 267-273.
- [12] J. Chen, X. Chen, *Special matrices*, Tsinghua Univ. Press, Beijing, 2001.
- [13] R.E. Gaines, J.L. Mawhin, *Coincidence Degree and Nonlinear Differential Equations*, Lecture Notes in Mathematics. 568. Berlin-Heidelberg-New York: Springer-Verlag, 1977. [MR0637067](#) (58 #30551). [Zbl 0339.47031](#).
- [14] A. Berman, R. J. Plemmons, *Nonnegative matrices in the mathematical sciences*, Computer Science and Applied Mathematics. New York, San Francisco, London: Academic Press. XVIII, 1979. [MR0544666](#) (82b:15013). [Zbl 0484.15016](#).

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