Editorial

Editorial for definitions of key terms in grey systems theory

The grey systems theory, established by Julong Deng in 1982, is a new methodology that focusses on the study of problems involving small data and poor information. It deals with uncertain systems with partially known information through generating, excavating, and extracting useful information from what is available. So, systems' operational behaviours and their laws of evolution can be correctly described and effectively monitored. In the natural world, uncertain systems with small data and poor information exist commonly. That fact determines the wide range of applicability of grey systems theory.

Since 1982, it gradually moves towards a mature period for grey system theory to grow from adolescence to young excessive. In the meantime, people reached a consensus on most of definitions of key terms in grey systems theory, the grey systems theory has formed a system structure that is generally accepted, and become a course at many universities all around the world. As an emerging discipline, the grey system theory is standing in the science forest with its strong vitality.

But in accordance with the laws of scientific development, a new subject needs to go through several generations of continuous work, and several decades or even a 100 years before it becomes mature. The theory of grey system has just been developed over 30 years, it has successful applications in many countries of the world, and has achieved a large number of achievements. However, it still needs a long way to go for further developments and improvements.

At the recent conference on grey systems and uncertainty analysis, many of our colleagues suggested that we should present definitions of key terms in grey systems theory because there are several different definitions of some terms in grey systems theory. They thought that unified definitions of key terms would be beneficial. Therefore, we have prepared the definitions of key terms. It includes 100 terms and divided into nine parts:

- (1) concepts and fundamental principles of grey systems;
- (2) grey numbers and its operations;
- (3) sequence operators and grey data mining;
- (4) grey incidence analysis models;
- (5) grey clustering evaluation models;
- (6) grey forecasting models;
- (7) combined grey models;
- (8) grey models for decision making; and
- (9) grey control system.

Which will be published one after another in coming issues of *Grey Systems: Theory* and *Application*.

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GS 6,3

426

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Further reading

- Deng, J.L. (1985), Grey Control Systems, Press of Huazhong University of Science and Technology, Wuhan (in Chinese).
- Deng, J.L. (1990), A Course in Grey Systems Theory, Press of Huazhong University of Science and Technology, Wuhan (in Chinese).
- Liu, S., Tao, L., Xie, N. and Yang, Y. (2016a), "On the new model System and framework of grey system theory", *The Journal of Grey System*, Vol. 28 No. 1, pp. 1-15.
- Liu, S., Yingjie, Y., Naiming, X. and Jeffrey, F. (2016), "New progress of grey system theory in the new millennium", *Grey Systems Theory and Application*, Vol. 6 No. 1, pp. 2-31.
- Liu, S.F. (2016b), *Grey System Theory and its Application*, 8th ed., Science Press, Beijing (in Chinese).

Editorial

427

| Liu, S.F. and Guo, | T.B. (1991), | Grey Systems | Theory an | nd Applications, | Press of Henan | University, |
|--------------------|--------------|--------------|-----------|------------------|----------------|-------------|
| Kaifeng. | | | | | | |

- Liu, S.F. and Lin, Y. (1998), An Introduction to Grey Systems: Foundations, Methodology and Applications, IIGSS Academic publisher, Grove City, PA.
- Liu, S.F. and Lin, Y. (2006), *Grey Information: Theory and Practical Applications*, Springer-Verlag, London Ltd, London.
- Liu, S.F. and Lin, Y. (2010), Advance in Grey Systems Research, Springer-Verlag, Berlin and Heidelberg.
- Liu, S.F. and Lin, Y. (2011), *Grey Systems Theory and Applications*, Springer-Verlag, Berlin and Heidelberg.
- Liu, S.F. and Xie, N.M. (2008), *Grey System Theory and its Application*, 4th ed., Science Press, Beijing (in Chinese).
- Liu, S.F. and Xie, N.M. (2012), Grey System Theory and its Application, 6th ed., Science Press, Beijing (in Chinese).
- Liu, S.F., Dang, Y.G. and Fang, Z.G. (2004), *Grey System Theory and its Application*, 3rd ed., Science Press, Beijing (in Chinese).
- Liu, S.F., Guo, T.B. and Dang, Y.G. (1999), Grey Systems Theory and Applications, 2nd ed., Science Press, Beijing.
- Liu, S.F., Yang, Y.J. and Wu, L.F. (2014), Grey System Theory and its Application, 7th ed., Science Press, Beijing (in Chinese).
- Liu, S.F., Dang, Y.G., Fang, Z.G. and Xie, N.M. (2010), *Grey System Theory and its Application*, 5th ed., Science Press, Beijing (in Chinese).
- Sifeng, L., Jeffrey, F. and Yingjie, Y. (2015), "Grey system: thinking, methods, and models with applications", in Zhou, M., Li, H. and Weijnen, M. (Eds), *Contemporary Issues in Systems Science and Engineering*, John Wiley & Sons, Inc., New York, NY, pp. 153-224.
- Sifeng, L., Yingjie, Y. and Jeffrey, F. (2016), Grey Data Analysis: Methods, Models and Applications, Springer-Verlag, Singapore.

GS 6.3