

# Linguistic Dynamic Systems for Computing with Words and Granular Computing

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**Abstract.** The term of Linguistic Dynamic Systems (LDS) was originally coined in earlier 1990s to reformulate logic programming for computing with words and granular computing dynamically and numerically. In the earlier stage of its development, fuzzy sets were used as the logic foundation for its analytical formulation and cell-to-cell mappings were applied in its computational framework. Therefore, many concepts and methods developed in ODE-based conventional dynamic systems can be used directly for computing with words and granular computing in LDS. Actually, cell mappings lead analysis in LDS to search problems in cell spaces, thus various search methods and techniques in Artificial Intelligence can be utilized for LDS. However, the procedure of transformation from fuzzy logic in hyper-cubes to cell-to-cell mappings in cell spaces is quite tedious and involving ad hoc steps in the process.

Both rough sets and type-2 fuzzy sets can be very useful in the improvement or even reformulation of LDS. Rough sets can lead to a connection between LDS and data mining, as well as granular computing, especially in dynamic construction and computing of value, variable, concept, and ontology granulation. There is a natural connection between LDS and type-2 fuzzy sets. As a matter of fact, a cell in cellular structured hyper-cubes is a specialized type-2 fuzzy set. New concepts and methods developed in the emerging type-2 fuzzy sets could be used in LDS for better design and improved computational efficiency in analysis of rule-based linguistic control systems. In this presentation, we will discuss and investigate the issues related to the relationship among LDS, computing with words, granular computing, and other methods.