Optimal fuzzy equivalent matrix-based fuzzy clustering method for hydrological station classification

JULIANG JIN\textsuperscript{1}, YOUFU ZHANG\textsuperscript{2} & WENSHENG WANG\textsuperscript{3}

\textbf{1} College of Civil Engineering, Hefei University of Technology, Hefei 230009, Anhui, China
jjll66@126.com

\textbf{2} Tourism District of Dongqian Lake Branch, Ningbo Planning Bureau, Ningbo 315121, Zhejiang, China

\textbf{3} College of Hydropower Engineering, Sichuan University, Chengdu 610065, Sichuan, China

\textbf{Abstract} The research focus of fuzzy clustering method applications, such as hydrological station classification, is a distortion of the transitive closure method, and may cause the rough clustered result problem by direct clustering method based on original fuzzy similar matrix $R$ produced from indexes values. For this reason, a computation problem of optimal fuzzy equivalent matrix $Q$ of $R$ was proposed to improve the matrix transitive degree and reduce distortion of $R$, an optimal scheme of $Q$ was designed based on accelerating genetic algorithm, clustering results were obtained directly based on $Q$, and then an improved fuzzy clustering method (AGA-OFEM) was established. The research results show that classification results of AGA-OFEM are both reasonable with high precision, that AGA-OFEM is simple and effective, and that AGA-OFEM possesses important theoretical meaning and broad application value in different applications in systems engineering.

\textbf{Key words} fuzzy clustering; fuzzy equivalent matrix; genetic algorithm; hydrological station classification