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Optimal operation of multi-reservoir systems for increasing power generation using a seagull optimization algorithm and heading policy

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Abstract
Power supply is a key issue for decision-makers. The reservoir operation of multi-reservoir systems is an important aspect to consider in efforts to increase power generation. This research studies a multi-reservoir system comprising of the Khersan-I (KHI), Karoon-III (KAIII) and Karoon-IV (KAIV) with the intent being to increase power generation. To achieve this, the Two-Point Heading Rule was integrated with a new optimization algorithm, namely the Seagull Optimization Algorithm (SEOA). The Two-Point Heading Rule was used based on four distinct scenarios, namely Two-Point Heading Rule (1), Two-Point Heading Rule (2), Two-Point Heading Rule (3) and Two-Point Heading Rule (4). The Seagull Optimization Algorithm was then used to find two heading parameters of the TPHRs. The Seagull Optimization Algorithm was subsequently benchmarked against the Salp Swarm Algorithm (SSA), Bat Algorithm (BA) and the Shark Optimization Algorithm (SOA). Various inflow scenarios consisting of the first inflow scenario (dry condition), the second inflow scenario (normal) and the third inflow scenario (wet condition) were considered for the optimal operation of this multi-reservoir system. The results indicated that the global solution of the MSOO based on NLP for Two-Point Heading Rule (1) under the first inflow scenario and was 3.22 while the average solution of Seagull Optimization Algorithm, Salp Swarm Algorithm, Shark Optimization Algorithm, and Bat Algorithm in respective order was 3.25, 3.93, 4.87 and 6.03. The results indicated that the global solution of the MSOO based on NLP for Two-Point Heading Rule (1) under the second inflow scenario was 2.14 while the average best solution of Seagull Optimization Algorithm, Salp Swarm Algorithm, Shark Optimization Algorithm, and Bat Algorithm in respective order was 2.16, 2.98, 3.96, and 4.89. It can be concluded that the SEOA outperformed all of the other algorithms. It was also found that the SEOA based on the Two-Point Heading Rule (3) under the third inflow scenario provided the most power generation for the KHI and KAIV systems. A multi-criteria decision was utilized to choose the best algorithm and heading policy. The ensuing results indicate that the SEOA had the best performance out of all the algorithms based on Two-Point Heading Rule (3) and the third inflow scenario. © 2021 The Authors

Author Keywords
Heading policy; Multi-reservoir operation; Power generation; Seagull Optimization Algorithm

Index Keywords
Decision making, Natural language processing systems; Bat algorithms, Heading policy, Multi-reservoir operation, Multi-reservoir systems, Optimization algorithms, Power- generations, Salp swarms, Seagull optimization algorithm, Swarm algorithms, Two-point; Optimization

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