FRAB-MAC: A Reliable Adaptive Broadcast MAC protocol for Mobile UACNs

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***Abstract*—The rapid development of Autonomous Underwater Vehicles (AUVs) enables AUV formations to execute complex tasks such as ocean exploration and remote surveillance. Information exchange within AUV formations relies on Underwater Acoustic Communication Networks (UACNs), where MAC protocol design is crucial for collision-free transmission and high network throughput. As a representative MAC protocol for mobile UACNs, AB-MAC enables collision-free broadcast communication among AUVs and improves network throughput through genetic algorithm-based optimization of transmission sequences. Moreover, we proposes FRAB-MAC, a reliable extension that incorporates reliability into the scheduling objective. By jointly optimizing the minimal frame length and a scoring-based reliability factor that accounts for the packet delivery probability between nodes, FRAB-MAC enhances the probability for AUVs to successfully receive control information, thereby significantly mitigating the likelihood of remaining silent. Meanwhile, FRAB-MAC employs a optimization algorithm based on the fire hawk optimizer (FHO), which effectively improves network throughput by generating optimal transmission sequences with minimal frame length. MATLAB simulation results demonstrate that FRAB-MAC shortens average frame length, reduces the number of silent nodes, and improves network throughput by an average of 15.06\% compared with AB-MAC.**

***Keyword*—AUV, MAC protocol, TDMA, fire hawk optimizer (FHO), Underwater acoustic communication networks (UACNs).**

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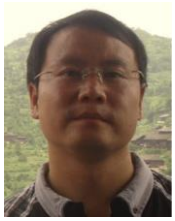

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