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ARTICLE

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PREDICTIVE AI-DRIVEN BEAM STABILIZATION FOR TERAHERTZ COMMUNICATIONS IN DYNAMIC MARITIME ENVIRONMENTS

SANTOSH KUMAR SHARMA[1], SHRUTI SHUKLA[2], SUBHANKAR SHOME[3] AND VANDANA YADAV[3]*

Directional THz wireless networks provide highcapacity maritime communications and gigahertz-wide bandwidths without the need to allocate bands. The narrow halfpower beam width, however, of THz beams ($\approx 1.5^0$), makes them extremely sensitive to spatial misalignment. For platforms on mobile ships, non-linear ocean swells create rotational jitter to the point where communication blackouts are permanent. To overcome this reactive tracking latency, this paper proposes a proactive and predictive artificial intelligence (AI) beam stabilization framework is presented. The proposed engine predicts the time evolution of the vessel's kinematics within a certain forward time horizon, allowing for anticipative corrections to steering, which removes the time lag caused by mechanical steering angle and velocity. Using simulation results, it is shown that the received power stays stable and predictable within a reliable signal envelope when severe sea swell occurs, giving the shipboard THz link budgets a resilient foundation, while static baselines and classical reactive PID controllers fail with a probability of 100% of link outage.