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P-74 Nonlinear Energy-Based Control Method for Aircraft Autopilot

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Air travel has become a very common means for both human and cargo transportation around the world. As more flying hours are required, modern aircrafts rely heavily upon automatic flight control systems although these systems are mainly controlled by human pilots. Future automatic flight control systems may even be able to reduce the number of pilot on duty for a particular flight to one or none. The most important issue to be addressed is still flight safety. Furthermore, as the use of unmanned aerial vehicles is rapidly increasing, automatic flight control systems become the brain of the systems. Therefore, control systems used on the aircraft has to be reliable and robust to undesirable conditions such as breakdowns and wind disturbances. An automatic flight control system using Nonlinear Energy-Based Control Methods (NEM) is proposed to track a particular flight trajectory for landing. This controller ensures the core attitudes of the aircraft such as roll, pitch, yaw and airspeed follows their reference value determined by the given flight trajectory. Simulation results show that the NEM controller is able to track the desired flight trajectory with its corresponding attitude commands in spite of a one-sided engine failure, wind shear, turbulence and parameter changes introduced to the aircraft.

P-75 Development of Duststorm Attenuation Model for Microwave Links

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Duststorms are significant meteorological phenomenon occur for a significant percentage of time in arid and semi arid areas especially at African Sahara and Middle East. Measurements at existing microwave links show that the duststorms can potentially result in serious attenuation in signal level especially at Ku band and higher frequencies with direct impact on telecommunications system performance. Very limited research has been done to predict the attenuation even the scarcity of measured data forces the researcher to work for the duststorm prediction modeling.

A mathematical model has been developed using Mie solution of Maxwell's equations for the scattering of electromagnetic wave by dielectric spherical particles which can predict attenuation in microwave bands. In this proposed model the term visibility is applied to denote the degree of duststorm density instead of total number of dust particles. The proposed mathematical model shows that the microwave signal attenuation due to duststorm depends on; visibility, frequency, dust particles radius, dielectric constant and moisture content during storm. The predicted dust attenuation from the proposed mathematical model are compared with those measured values in Saudi Arabia and Sudan. It shows relatively more close agreement, than the existing model proposed by Goldhirsh.

Based on long term duststorm data, fade margins by duststorm have been investigated for microwave links and presented. In the design of communication systems operating at frequencies above 10 GHz in arid or semi arid areas, it is recommended to consider the duststorm attenuation in radio planning and link budget analysis. A regional propagation map is needed to consider the duststorm characteristics spatially the visibility data and occurrence probability information. Finally, the proposed mathematical model will be useful as a good method to predict the attenuation in microwave signal due to duststorm.