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Quadrotor helicopter control using vanes

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Quadrotors are one of the most favorable vertical take-off and landing aircraft (VTOL) especially for unmanned surveillance (UAV). The quadrotor offers inherent advantages over conventional helicopters. Till now rotary-wing aircrafts and quadrotors must tilt to gain movement in any direction. This tilting action can create problems especially when cameras and other sensors are used. Here, we present a solution to this problem by using four controllable vanes. Each vane is located below a rotor. The vane job is to deflect the air stream by any desired angle to move the quadrotor in that direction in the horizontal plane without causing the plane to change its horizontal attitude. Each two opposite vanes are parallel and connected to one servomotor using pushrods. This parallel deflection generates a force with a horizontal component that moves the quadrotor horizontally without tilting. The quadrotor can be maneuvered in any direction by deflecting all four vanes simultaneously with any differential angle settings. A feedback controller is designed for quadrotor attitude using the classical technique of varying the motors speed to ensure the stability and to keep the vehicle level which is very important to prove the control scheme using vanes. Various flight experiments and simulations are performed to validate the proposed concept. Actual flight experiments were conducted in a 5m x 5m x 8m space equipped with wall nets and soft ground as a safe environment. The results showed that the proposed concept may provide a promising solution to the tilting problem.

Biography

Khaled Asfar is a professor in the Mechanical Engineering Department at Jordan University of Science and Technology (JUST). He received his PhD degree from Virginia Tech in 1980, his M.S. from Virginia Tech in 1978, and his BS from Riyadh University in 1975. He is currently the Director of the Center of Excellence for Innovative Projects at JUST University. He also manages the Technological Incubator at the Center. He was a visiting research scholar at the Aerospace Engineering Department at Texas A & M University in 2007/2008 and a visiting professor at the School of Mechanical Engineering/Purdue University from 2008 to 2010.

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