Preface

Unmanned Aerial Vehicles (UAVs) are developed today to perform more demanding tasks. Both civil and military applications require autonomous vehicles with increased performance and capabilities. Modeling and nonlinear controller syntheses have been essential tools for stabilizing the orientation of helicopters using measurements from an IMU (Inertial Measurement Unit). Such techniques have been used for stabilizing different configurations including the classical helicopter, quadrotors as well as other types of rotorcrafts. In order to stabilize a helicopter at a desired hovering position we require a position measurement system. GPS (Global Positioning System) is one of the most common position sensors. However, GPS position measurement error can be significant due to obstacles (buildings, weather conditions, etc.). In GPS denied areas Computer Vision can be used as an alternative position measurement system.

This book is devoted to study how a computer vision system can be used onboard to estimate the translational velocity of the aircraft and the position of the helicopter with respect to landmarks in the environment. Horizontal velocity of the rotorcraft is achieved by using the optical flow measurement in the feedback control law. The tasks of hovering at a desired point as well as velocity regulation are accomplished by using the position and velocity measurements with respect to landmarks in the environments. Stereo vision is also studied with the purpose of enabling the aerial vehicle to localize itself in unstructured indoors environments. The different approaches proposed have been tested in experimental platforms which are illustrated in this book.

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