

Flying robots summary

Flying robots, so called unmanned aerial vehicles (UAV) or unmanned aircraft systems (UAS) are flying vehicles without carrying a human. UAVs are controlled by human, but UAS are autonomous. Both are mostly used in military, but recently civil use has increased. Besides bombing, UAS can be used to carry supplies and gathering information. As in civil use they are used for example delivering.

20th century world conflicts accelerated the development of flying robots. Automatic plane, developed by Hewitt-Sperry, was used in World war I. It acted as a flying torpedo, carrying intelligence over long periods of time. During World War II German army developed V-1, that was one of the first successful cruise missiles. Even it had limited success rate it contained most of the elementary components, estimation algorithms and control loops that allowed autonomous navigation and reference tracking. The UAV that we know today, was first developed in 1970s. It included cameras, GPS and other sensory systems.

Flying robot's classification is more complex than manned aerial vehicles. The name UAV can be used systems of different scale, mechanical configuration, and actuation principles. They are classified by their properties. The most common flying robots are fixed-wing unmanned aerial systems and rotary-wing unmanned aerial systems. Even they have same features than in manned aerial vehicles, several design aspects are different. The other well-known systems are lighter-than-air, convertibles, and bio-inspired systems.

For planning an UAS you need a fundamental knowledge of aerodynamics. You need to be aware of difference between aerodynamic, generated by the motion of the object, and aerostatic lift, formed solely by static properties of the object. Airflow around the aircraft is usually three-dimensional and unsteady. You need to know how to exploit the airflow and be able to calculate lift and drag. To avoid viscous effects, you need to consider the materials of boundary layer. Other than these, you need to know the difference between different kind of propels and rotors, to control properly the UAS.

There are several challenges of designing and building an UAS. They differ a lot of ground vehicles. The limitations of weight and power consumption, bring many challenges. All the equipment, such as processors, sensors and cameras need to be as light as possible. Algorithms need power to handle the data. Other major challenge is to fit all the components together. The communication between different components is critical for controlling the vehicle.

With different kind of applications, the UAS can be autonomous. Applications have been used to control UAS in remote sensing, disaster response, surveillance, search and rescue, image acquisition, communications, transportation, and payload delivery.

In conclusion, flying robots can be used in several tasks, but building them also requires lots of knowledge.