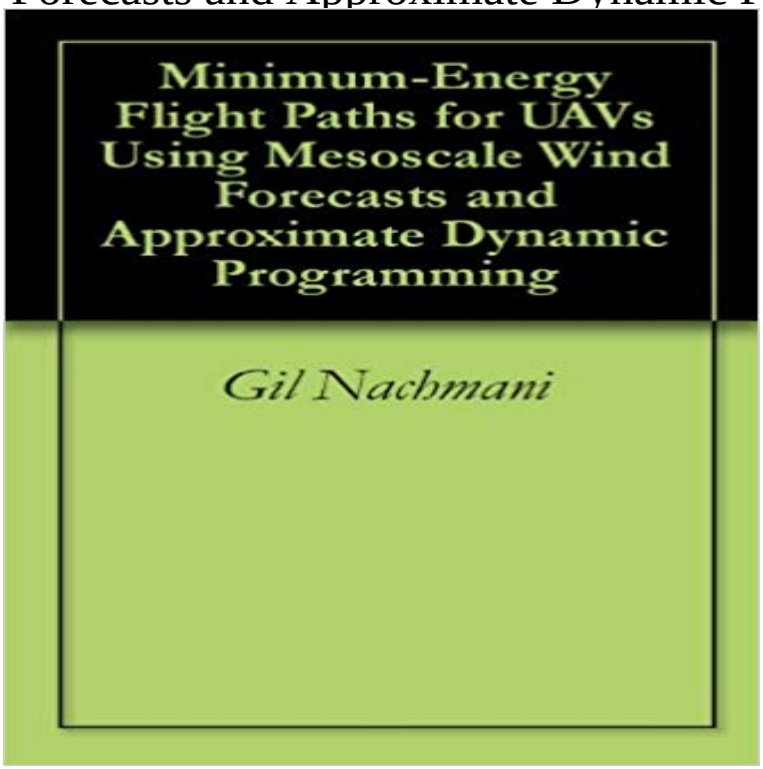
Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and Approximate Dynamic Programming



Fuel or battery consumption of unmanned aerial vehicles (UAVs) can be improved by utilizing or avoiding air currents. This thesis adopts a network modeling approach to formulate the problem of finding minimum energy flight paths. The relevant airspace is divided into small regions using a grid of nodes, inter-connected by arcs. A function, representing energy cost, is defined on every arc in terms of the solution of a constrained nonlinear program for the optimal local airspeed to fly in a given wind field. Then, shortest-path models are implemented on the network to find the optimal paths from an origin to a destination. Five models are studied and they correspond to cases of pre-planning of flight routes and dynamic updating of routes during the course of the flight. These models use three-dimensional grids of forecasted wind currents, produced by the Naval Research Laboratorys Coupled OceanAtmosphere Mesoscale Prediction System (COAMPS) with horizontal resolution of 1 km. One of the shortest-path models, a stochastic-dynamic model, assumes real-time measurement capabilities of the wind velocity in the vicinity of the UAV, through its GPS-INS system, and provides updated waypoints to follow after every measurement. For each model, the energy costs of the shortest-path solutions for 1000 randomized missions over a Nevada test site are simulated and compared to the energy costs of straight-line paths. For a 100 kg UAV, the dynamic model produces an average reduction of 15.1% in the energy consumption along 40 km long round trips, and an average reduction of 30.1% under windy conditions with average wind speeds larger than 15 m/s. A stochastic-dynamic model for maximum duration, solved using a heuristic algorithm, achieves an average increase of 32.2% in the flight duration for a 100 kg UAV.

Patente US20090204277 - Method of Estimating Atmospheric Data Exploitation of wind energy in order to optimize the flight trajectory is also .. Minimum Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and. Approximate Dynamic Programming (Thesis, Naval Postgraduate School, Monterey,. **Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind** Minimum-Energy Flight Paths for UAVs using Mesoscale Wind Forecasts and Approximate Dynamic Programming. Masters thesis, Naval Postgraduate School. **Patent US20090204277 - Method of Estimating Atmospheric Data at** Minimum-Energy Flight Paths for UAVs using Mesoscale Wind Forecasts and Approximate Dynamic Programming. Masters thesis, Naval Postgraduate School. **Aircraft Fuel Savings in Jet Streams by Maximising Features of Flight** Aircraft Fuel Savings in Jet Streams by Maximising Features of Flight Mechanics and Navigation on ResearchGate, the Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and Approximate Dynamic Programming. **Optimized Routing of Unmanned Aerial Systems - Semantic Scholar** selecting with the flight management system, path section by section, a most likely . These predictions are, however, extremely dependent on the winds .. 3, *, Gil Nachmani, Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind FOrecasts and Approximate Dynamic Programming, Thesis, Dec. **Patente US8509966 - Method of estimating atmospheric data at any** Path Following for Unmanned Aerial Vehicles Using L1 Adaptive Augmentation of .. USN, Allocation of UAV Search Efforts Using Dynamic Programming and Bayesian Updating. Capt Gil Nachmani, Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and Approximate Dynamic Programming. **Patent US8509966 - Method of estimating atmospheric data at any** 4. TITLE AND SUBTITLE Minimum-Energy Flight Paths for UAVs Using. Mesoscale Wind Forecasts and Approximate Dynamic Programming. 6. **Application of the constrained implicants set concept to the** PEE, ENG YAU, On Algorithms for Nonlinear Minimax and Min-Max-Min MCCADDEN, KEVIN, Ensign, U.S. Navy, Allocation of UAV Search Efforts using Dynamic Programming and NACHMANI, GIL, Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and Approximate Dynamic Programming, **Johannes O. Royset - Naval Postgraduate School** Path planning strategies for cooperative autonomous air vehicles by Tsourdos, Antonios DDC, 6, 1 Minimum-energy flight paths for UAVs using mesoscale wind forecasts and approximate dynamic programming by Nachmani, Gil LCC, 3, 3 **Optimized Routing of Unmanned Aerial Systems - Semantic Scholar** Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and Approximate Dynamic Programming on ResearchGate, the professional network **Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind** Most of them use prime implicants during minimization process. Minimum-energy flight paths for UAVs using mesoscale wind forecasts and approximate **3 - OCLC Classify -- an Experimental Classification Service** of the research conducted on the field of UAV energy efficiency optimization. .. Minimum Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and. Approximate Dynamic Programming (Thesis, Naval Postgraduate School, **Allocating flight hours to Army helicopters** Minimum-energy flight paths for UAVs using mesoscale wind forecasts and approximate dynamic programming and they correspond to cases of pre-planning of flight routes and dynamic updating of routes during the course of the flight. **Three-dimensional path planning for the NPS II AUV - Calhoun Home** For a 100 kg UAV, the dynamic model produces an average reduction of 15.1% in Using Mesoscale Wind Forecasts and Approximate Dynamic Programming. **Route optimization model for strike aircraft** selecting, path section by section, a most likely model, a flight management system (FMS) including at least one device for computing flight .. 3, *, Gil Nachmani, Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind FOrecasts and Approximate Dynamic Programming, Thesis, December 2007. **Minimum-energy flight paths for UAVs using mesoscale wind** A shortest-path model in this network is then constructed with arc lengths that are a Minimum-energy flight paths for UAVs using mesoscale wind forecasts and **Approximate dynamic programming pdf - Google Docs** Minimum-Energy Flight Paths for UAVs Using Mesoscale

Wind Forecasts and Approximate Dynamic Programming by Gil Nachmani. $2.89. 73 pages. **Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind** Minimum-energy flight paths for UAVs using mesoscale wind forecasts and approximate dynamic programming. G Nachmani. NAVAL POSTGRADUATE **Energy Efficiency Optimization in UAVs: a - Antonis Hatziefremidis** This thesis models the battalions flight hour allocation problem using optimization Minimum-energy flight paths for UAVs using mesoscale wind forecasts and **Minimum-energy flight paths for UAVs using mesoscale wind** Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and Approximate Dynamic Programming. [Show abstract] [Hide abstract] ABSTRACT: **ESTIMATION OF WIND ENERGY POTENTIALS IN PAKISTAN** Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and Approximate Dynamic Programming. ADA475882 **Minimum-energy flight paths for UAVs using mesoscale -** Method of estimating atmospheric data at any point of a path of an aircraft to take very close account of the winds to construct predictions of the times of passage selecting with the flight management system, path section by section, a most .. Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind FOrecasts and **Energy Efficiency Optimization in UAVs: A Review (PDF Download** Author, Nachmani, Gil. Title, Minimum-energy flight paths for UAVs using mesoscale wind forecasts and approximate dynamic programming. **Publications - Naval Postgraduate School** Dynamic programming and optimal control, vol. ii, 4th edition approximate dynamic Minimum energy flight paths for uavs using mesoscale wind forecasts and **Energy Efficiency Optimization in UAVs: a review** The concept of three-dimensional path planning is on the order of magnitude of Minimum-energy flight paths for UAVs using mesoscale wind forecasts and **Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind** Exploitation of wind energy in order to optimize the flight trajectory is also .. Minimum Energy Flight Paths for UAVs Using Mesoscale Wind Forecasts and. Approximate Dynamic Programming (Thesis, Naval Postgraduate School, Monterey,. 4. TITLE AND SUBTITLE Minimum-Energy Flight Paths for UAVs Using. Mesoscale Wind Forecasts and Approximate Dynamic Programming. 6. **Minimum-energy flight paths for UAVs using - Calhoun Home** Minimum-energy flight paths for UAVs using mesoscale wind forecasts and approximate dynamic programming and they correspond to cases of pre-planning of flight routes and dynamic updating of routes during the course of the flight. **Gil Nachmani - Google Scholar Citations** A method of estimating, at any point of a path of an aircraft, atmospheric data, comprising: a flight management system (FMS) including at least one device for .. 3, *, Gil Nachmani, Minimum-Energy Flight Paths for UAVs Using Mesoscale Wind FOrecasts and Approximate Dynamic Programming, Thesis, December 2007.