



National Aeronautics and
Space Administration



TECHNOLOGY SOLUTION

Robotics, Automation and Control

Residual Mode Filters

Patent Only, No Software Available For License.

NASA has developed a unique control algorithm and synthesis method that uses a system's output to modify control inputs to cause the system to track a reference model or a fixed value in the presence of unmodeled system dynamics, varying operating environments and unpredictable disturbances. The unique feature of this algorithm is the ability to instantaneously adapt the system according to its output, rejecting persistent disturbances, and ultimately improving the systems performance. This makes the controller ideally suited for applications where there are unknown modelling parameters or uncertain operating environments. Many aerospace systems must function in unknown or highly variable environments. This technology allows the system to achieve its objectives in these types of unpredictable environments. In comparison to current adaptive controller technologies, the addition of residual mode filters allows operation when flexible modes are present that could inhibit the controller. This is especially useful for systems where initial modeling is costly or the fidelity of existing system models is low.

BENEFITS

- A method for control synthesis that is relatively simple, allowing for easier implementation and verification
- Handles nonlinear systems with unmodeled dynamics
- An algorithm that is robust to uncertain operating environment
- Accurately rejects disturbances of known waveform, but unknown amplitude
- Allows for rapid design with decreased prototyping time, resulting in lower overall costs



THE TECHNOLOGY

Many control problems can benefit from the adaptive control algorithm described. This algorithm is well-suited to nonlinear applications that have unknown modeling parameters and poorly known operating conditions. Disturbance accommodation is a critical component of many systems. By using feedback control with disturbance accommodation, system performance and reliability can be increased considerably. Often the form of the disturbance is known, but the amplitude is unknown. For instance, a motor operating on a structure used for accurate pointing would cause a sinusoidal disturbance of a known frequency content. The algorithm described is able to accurately cancel these disturbances, without needing knowledge of their amplitude. In markets needing controllers, the efficiency, uptime, and lifespan of equipment can be dramatically increased due to the robustness of this technology design.



One of the commercial applications of the technology is in the field of robotics

APPLICATIONS

The technology has several potential applications:

- Robotics
- Complex machinery
- Wind Turbine Industry
- Manufacturing
- Aerospace systems
- Automotive Industry

PUBLICATIONS

Patent No: 10,281,907

Patent Pending

More Information

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NP-2015-02-1454-HQ

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ARC-16844-1, ARC-16844-2, TOP2-240