

# 360-Degree Rotation Data as Linear Signal

## NASA offers companies

the opportunity to license or jointly develop these innovative technologies.



NASA Marshall Space Flight Center has developed innovative resolver signal-conditioning technologies that provide rotational position information over a full 360 degrees. Furthermore, an electrical circuit conditions the output so that the shaft angle position is represented by a linear analog signal. The features of NASA's new technologies offer several advantages over standard resolver signal-conditioning circuits. In addition, these circuits can be used in many commercial applications.

### Benefits

- ▶ Full 360-degree range
- ▶ Continuous linear output
- ▶ Simple design
- ▶ Inexpensive implementation with existing resolvers
- ▶ Excellent noise immunity
- ▶ Precision components and gain- and phase-matching not required

### Commercial Applications

These technologies are useful in any application that uses a resolver:

- ▶ Printers, photocopiers, fax machines
- ▶ Electric motors
- ▶ Robotics
- ▶ Medical scanners
- ▶ Antilock brake systems
- ▶ Integrated circuit design





## The Technology

One of the most robust, reliable, and often used position sensors is a resolver. Resolvers use external excitation signals, arctangent integrated circuits, resolver-to-digital integrated circuits, and output signal conditioning to determine angular position. Commercially available arctangent integrated circuits can operate only between  $-90$  degrees and  $+90$  degrees. This limitation is a problem for applications that require measurement over a full 360 degrees. Researchers at NASA Marshall Space Flight Center have developed a technology that solves this problem by providing a linear output for 360-degree rotation.

In addition, some resolver circuits offer 360-degree sensing using precision analog circuitry and trigonometric identities. However, these circuits and identities are noise-sensitive, require precision components as well as gain- and phase-matching, and tend to drift with changes in temperature. NASA Marshall researchers also have invented a circuit that avoids these limitations and is lower in cost than typical resolver signal conditioning circuits.

## Partnering Opportunities

These resolver signal-conditioning technologies are part of NASA's technology transfer program. The program seeks to stimulate commercial use of NASA-developed technologies. Patent applications have been filed for these technologies, and development and testing are continuing. NASA invites commercial companies to consider licensing or jointly developing these technologies. NASA is flexible in its agreements, and opportunities exist for exclusive, nonexclusive, and exclusive field-of-use licensing.

## For More Information

If you would like more information about these technologies or about NASA's technology transfer program, please contact:

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More information about working with NASA Marshall's Technology Transfer Department is available online.

[www.nasasolutions.com](http://www.nasasolutions.com)