# USF Available Technologies

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# Phase Imaging Using Multi-Wavelength Digital Holography

Researchers at the University of South Florida have developed a system and method that will produce high resolution holograms for objects with surface discontinuities greater than 2π, thus eliminating the problem of 2π ambiguity.

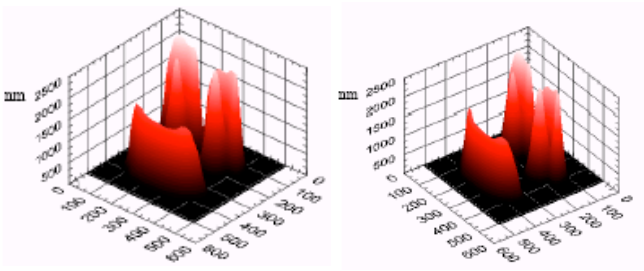
The advent of the charged coupled device (CCD) and digital cameras allows the application of digital technology to the field of holography, eliminating the need for film recordings. Digital holograms offer many advantages over film recordings. For example, reconstruction of the image is carried out using software which permits more control over the reconstructed image in addition to reducing the time and cost of the hologram. Current digital holograms, however, suffer from what is referred to as the 2π ambiguity problem. This occurs when phase images of the target object has axial ranges greater than one wavelength. Phase unwrapping techniques have been developed to resolve this issue. However, they do not work well with phase maps that are not well behaved or that have a speckle that must be first removed. They are also time consuming, limiting applications to real-time measurements.

Our researchers have developed a novel phase imaging method which combines digital holographic phase mapping and contour generation, to eliminate the problem 2π ambiguity. The contour generation is used to determine what fringe number a pixel is on, and the phase map is then used to produce sub-wavelength resolution. This makes it possible to obtain detailed sub-wavelength resolution over several wavelengths of range without the use of phase unwrapping algorithms.

## ADVANTAGES:

- **Eliminates 2π-ambiguity**
- **Does not use phase unwrapping techniques**
- **Produces high resolution holograms**

*Novel High Resolution Holograms*



*Left image: Original 3-D object.*

*Right image: Recreated object*

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