



# 3D printing on Moving Freeform Surfaces

**IP Status:** US Patent Issued;11,794,413

## 3D printing electronics onto moving surfaces

Adaptive 3D printing is a new approach that allows 3D printing on moving freeform surfaces. The closed-loop method combines direct ink writing of functional materials and real-time feedback control to fabricate devices on moving surfaces. The hybrid fabrication procedure, which combines conformal 3D printing of electrical connects with automatic pick-and-place of surface-mounted electronic components, printed functional devices on a free-moving human hand. This adaptive 3D printing method could lead to new manufacturing technologies for directly printed wearable devices and advanced medical treatments (e.g., wound healing).

## Closed-loop, adaptive 3D printing technology

Current 3D printing technologies typically rely on open-loop, calibrate-then-print operation procedures and are limited to 3D printing on planar surfaces. Previous attempts to track and ink-jet print on a moving human hand were limited to gesture tracking in 2D without compensation for the geometries of the hand surface. This new closed-loop, adaptive 3D printing technology can track arbitrary surface motions in 3D and therefore print onto moving and deformable surfaces with arbitrary geometries. This approach addresses the limitations of previous techniques by correcting, in real-time, printing errors from both the freeform geometries and the 3D motions and deformations of the target surfaces.

## Phase of Development

- Working prototype

## Benefits

- Real-time feedback control

## Features

- 3D printing on moving and deformable freeform surfaces
- Direct ink writing of functional materials
- Integrated robotic system aided by computer vision
- Closed-loop method

## Applications

- On-demand, directly printed wearable devices
- Tissue repair
- Smart manufacturing technologies

## Researchers

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## Technology ID

20180198

## Category

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## Publications

[\*3D Printed Functional and Biological Materials on Moving Freeform Surfaces\*](#)

*Advanced Materials*, June 6, 2018. Volume 30, Issue 23

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