

The Variational Principle in Transformation Optics Engineering and Some Applications

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Transformation optics is an emergent field of engineering with a great impact on recent developments in advanced optical devices. With the help of differential geometry, transformation optics allows us to fully control electromagnetic fields in an unprecedented manner.

On the other hand, variational principles mathematically describe in a concise and elegant way a great variety of natural phenomena, independently of a particular choice of coordinate system. In this work, we extend this concept in a differential-geometric framework to formulate transformation optics in an inherently covariant fashion.

As a direct application, we present the construction of reflectionless devices relevant in bio- and nano-technology. Especially, we focus on the improvement of current limits on resolution and reflection properties of typical optical devices, such as lenses and wave-guide couplers.