Knowledge Transfer Office
香港城市大學
City University of Hong Kong

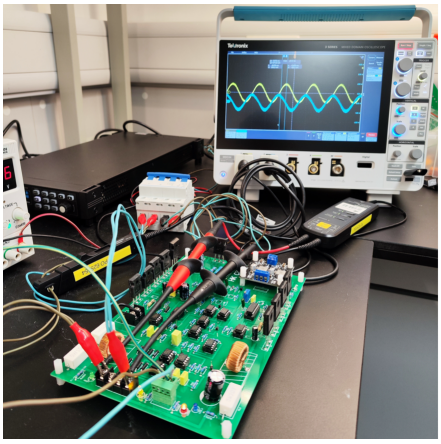
Negative Reactance: A Game Changing Device for Power Applications

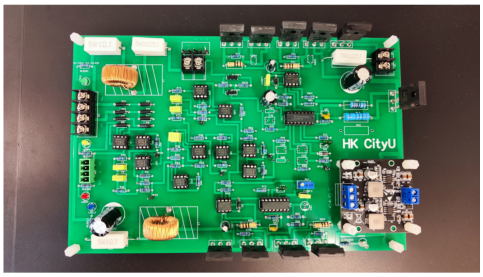
Energy & Environment

Consumer Electronics

Electricity and Power Electronics

Energy Conservation/Generation/Management/Storage (Battery)





Remarks

3rd Asia Exhibition of Innovations & Inventions Hong Kong (AEII) (2023) - 1. Special Prize - IFIA Award
2. Gold with Congratulations of Jury Award

IP Status

Patent filed

Technology Readiness Level (TRL) ?

5

Opportunity

Negative reactance, a previously absent concept in the real world, will enable the easy resolution of one of the most common problems in electrical systems! Power and energy systems often face limitations in power capacity and efficiency due to the inevitable presence of unwanted reactive power circulation. Employing a dual reactive element to counteract any unwanted reactance has been the only solution choice, for example, using capacitance to counteract leakage inductance. Such solutions involve complicated design processes and costly realizations due to the resonance nature of reactive power compensation. Up to now, there has been no alternative due to the absence of negative-valued counterparts for capacitance and inductance in the real world. Our negative inductance synthesizer can cancel real inductance directly, and change the way compensation has been done in the past century! No more resonance! No more frequency sensitivity! No more need for precision design!

Technology

Reactance with a negative value is inherently unstable, and has never existed as a standalone component in the real world. To ensure the reactance property be maintained for power applications, we employ switching power converters to process electric power and apply a set of advanced control circuity to define the input current and voltage relationship that complies with the negative-valued reactance in both time and frequency domains. Key technological hurdles include the delicate balance of power at the critical stability point and the inherent instability in the presence of any small real

Inventor(s)

Prof. TSE Chi Kong

Dr. DING Li

Enquiry: kto@cityu.edu.hk

resistance in the application circuit. Negative reactance synthesizers have undisputable practical significance as the century-old compensation problem has now found a direct and much simpler alternative solution.

Advantages

- Solving the most common and unavoidable problem in every electrical system
- Direct cancellation of real-valued reactance by negative-valued reactance
- Insensitive to frequency, circuit parameters and component values
- Complete elimination of conventional resonance circuit design

Applications

- Power quality enhancement in electrical power systems
- Drastic simplification of compensation in wireless power transfer systems
- Control systems in renewable energy applications
- Elevating power capacity in power electronics equipment