Electric Springs – A new Smart Grid Technology

電氣彈簧 - 智能電網新技術

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From Mechanical Springs to Electric Springs
從「機械彈簧」到「電氣彈簧」

• Since the Hooke’s law was published in the 1660’s, there has NOT been any “electric” version of the “mechanical” spring.

• 自虎克定律發表以後(350多年),機械彈簧並沒有在電科技上發展．

• The HKU/Imperial College team have successfully developed the world’s 1st “Electric Spring”. (patent pending)

• 香港大學和倫敦帝國學院已成功研制全球第一台「電氣彈簧」. (已申請專利權)
**Principle of Electric Springs**

電氣彈簧的原理

(a-1) Neutral position

(b-1) Mechanical push (upward force)

(c-1) Mechanical pull (downward force)

(a-2) Neutral position

(b-2) Voltage boosting function

(c-2) Voltage reduction function

Mains Voltage 220V

電壓 220V
Applications of Electric Springs
電氣彈簧的應用

• To stabilize future power grid with large-scale wind and solar power generation

• 穩定未來採用大規模的風能和太陽能發電的智能電網.
Future power systems adopt “distributed” power generation and “multi-directional” power flow structure.

未來的電力系統採用「分佈式」發電和「多向式」輸電結構
Electric Spring
電氣彈簧

• An electric spring is a **power electronics** system.
• 電氣彈簧是一種 **電力電子** 系統

• It can be embedded in an electric appliance such as electric water heater or refrigerator.
• 它可以 **安裝再電器產品內** (例如電熱水器和電冰箱)

• Electric springs can therefore be ‘**distributed**’ over the power grid to stabilize the mains voltage in the presence of a large % of intermittent renewable power generation.
• 因此它們可以 **分佈** 在整個電網內，用以穩定電壓
The HKU and ICL research team members have successfully developed the world’s 1st Electric Spring.

Electric Springs can stabilize future power grid with a high % of intermittent renewable energy generation (Wind and Solar Power).

Electric Springs do not need communication and, collectively, they provide highly robust stability functions for power systems.

We discover that the 3-century old Hooke’s law has laid down the foundation for smart power grid in the 21st century.

Conclusion
結論

• 香港大學/倫敦帝國學院的研究團隊已成功研制全球第一個電力彈簧.

• 電力彈簧可以穩定未來含有大量間歇性的可再生能源電力系統(風能和太能).

• 電力彈簧不需要通訊系統. 它們能夠集體地為電力系統提供極其穩定的功能.

• 我們發現三百多年的虎克定律, 已經為廿一世紀的智能電網, 定下穩定技術的基礎.