



Electric Springs – A new Smart Grid Technology

電氣彈簧 - 智能電網新技術

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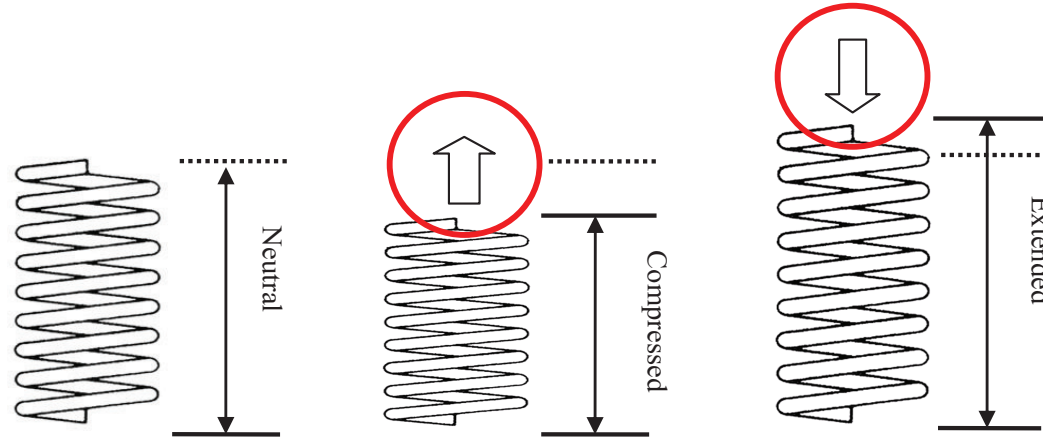
From Mechanical Springs to Electric Springs

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

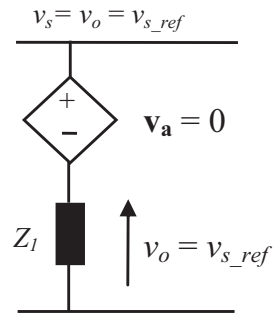


(a-1)
Neutral position

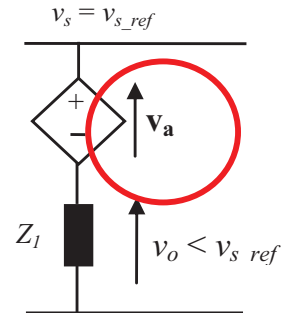
(b-1)
Mechanical push (upward force)

(c-1)
Mechanical pull (downward force)

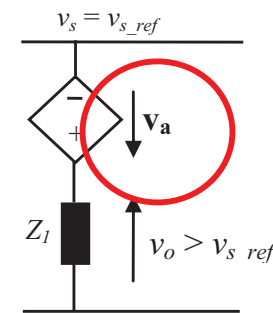
Mains Voltage 220V
電壓 220V



(a-2)
Neutral position



(b-2)
Voltage boosting function



(c-2)
Voltage reduction function

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.

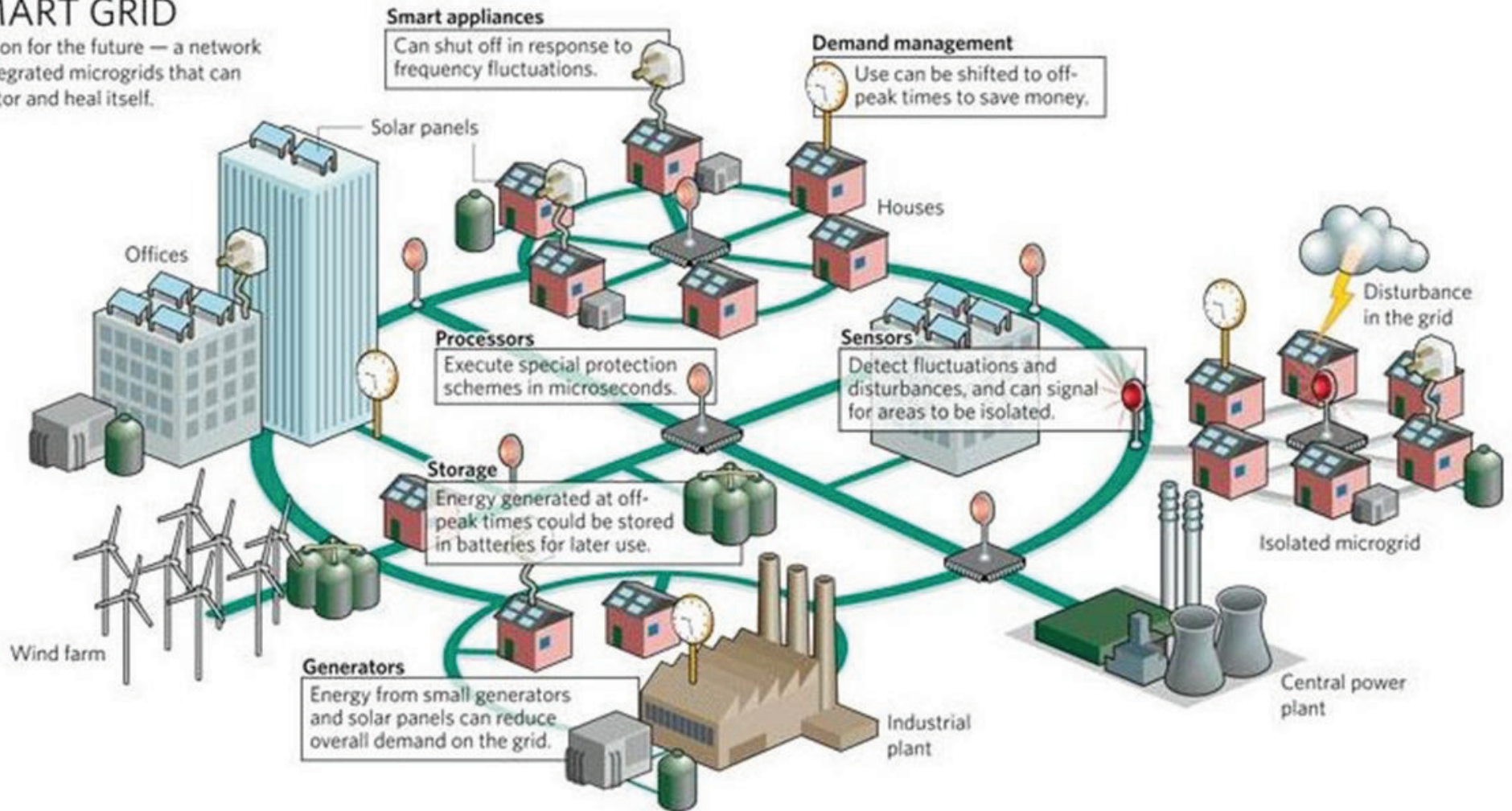


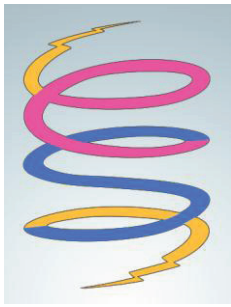
Future power systems adopt “distributed” power generation and “multi-directional” power flow structure.

未來的電力系統採用「分佈式」發電和「多向式」輸電結構

SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.





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

Conclusion

結論

- The HKU and ICL research team members have successfully developed the world's 1st Electric Spring.
- 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**.
- Electric Springs can stabilize future power grid with a high % of intermittent renewable energy generation (Wind and Solar Power).
- 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**(風能和太陽能).
- Electric Springs do not need communication and, collectively, they provide highly robust stability functions for power systems.
- 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**.
- We discover that the 3-century old Hooke's law has laid down the foundation for smart power grid in the 21st century.
- 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.