

# Electrical Tests on the Composite Cross-Arm and Pylon

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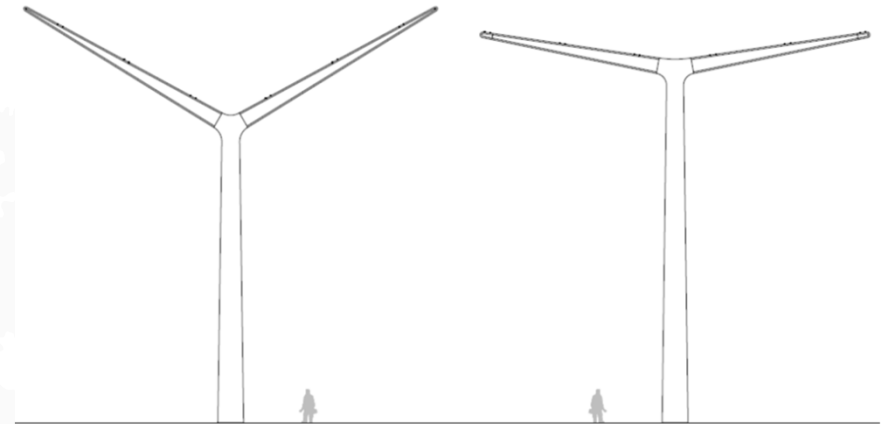
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# □ Power Pylons of the Future

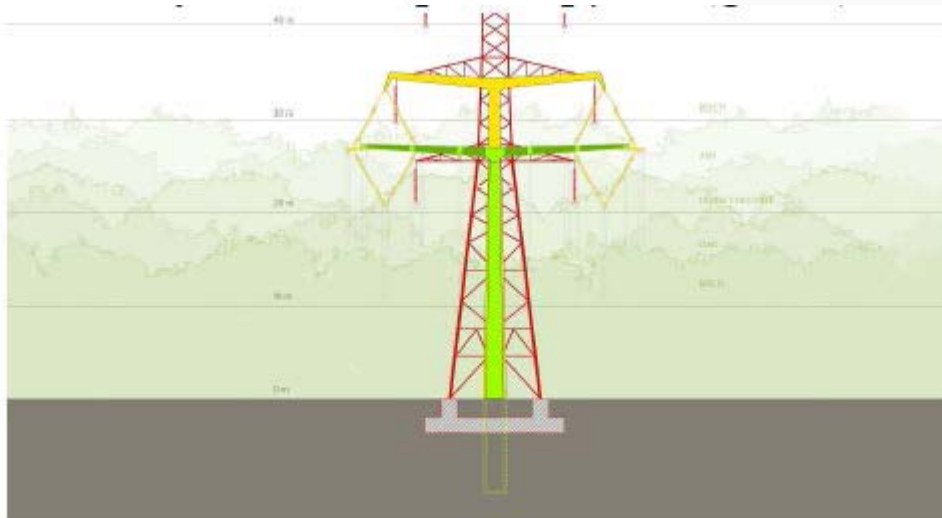


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Traditional transmission

400 kV double circuit composite pylon



Comparison between traditional towers and the novel pylon

## Advantages

- More compact structure;
- Better visual impact in environment;
- Equivalent or even better power transmission capacity;
- Competitive installation and maintenance cost.

## □ Objectives



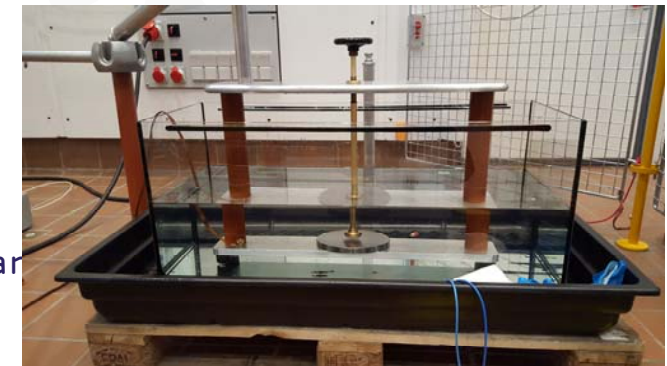
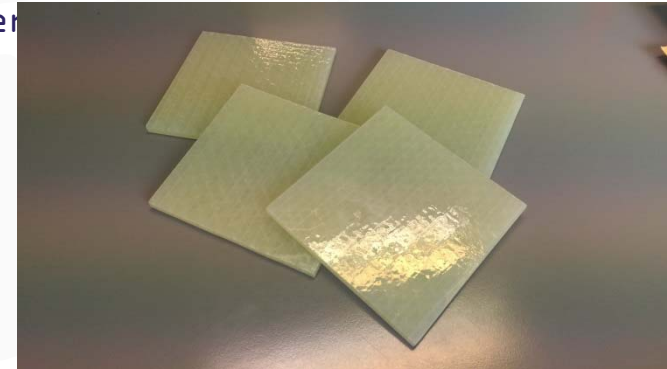
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- Planning, design and construction of rigs and setups for tests on the composite material, cross-arm and pylon;
- Selection of suitable composite materials in the cross-arm and pylon body;
- Evaluation of the composite cross-arm's insulation performance;
- Verification of composite pylon's lightning protection system;
- Investigation of the whole composite pylon (combined test with mechanical load).



## □ Material selection

- Alternative materials:
  - Fiberglass reinforced epoxy / vinyl ester
- Alternative manufacturing methods :
  - Vaccum consolidation;
  - Hose;
  - Filament winding.
- Pure electrical tests:
  - Dielectric property test;
  - Partial discharge test;
  - Breakdown test.
- Combined test:
  - Simultaneous electrical stress and mechar



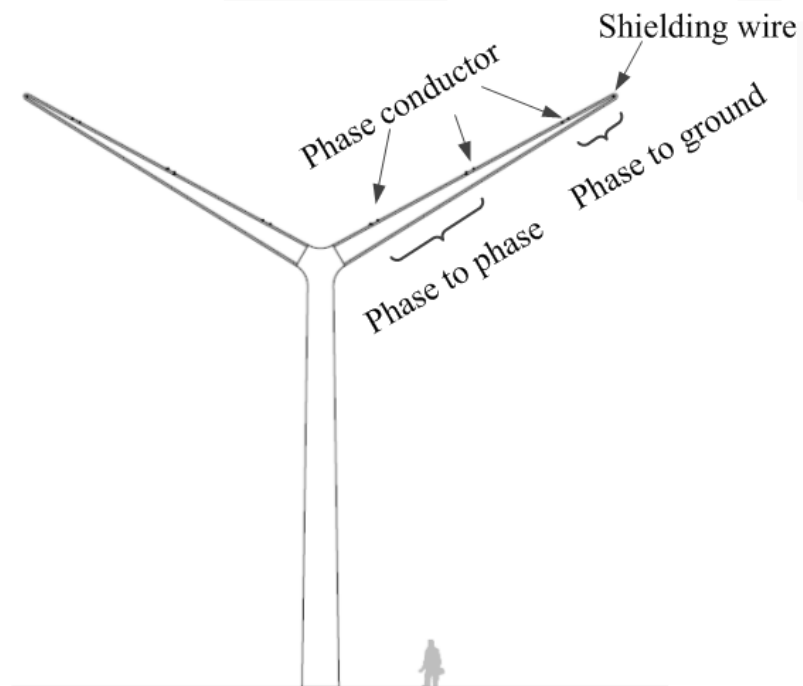
## □ Small/full scale of the cross-arm test

- Pure electrical tests:

Insulation level: (50 Hz flashover voltage in dry/wet condition)

- Combined test:

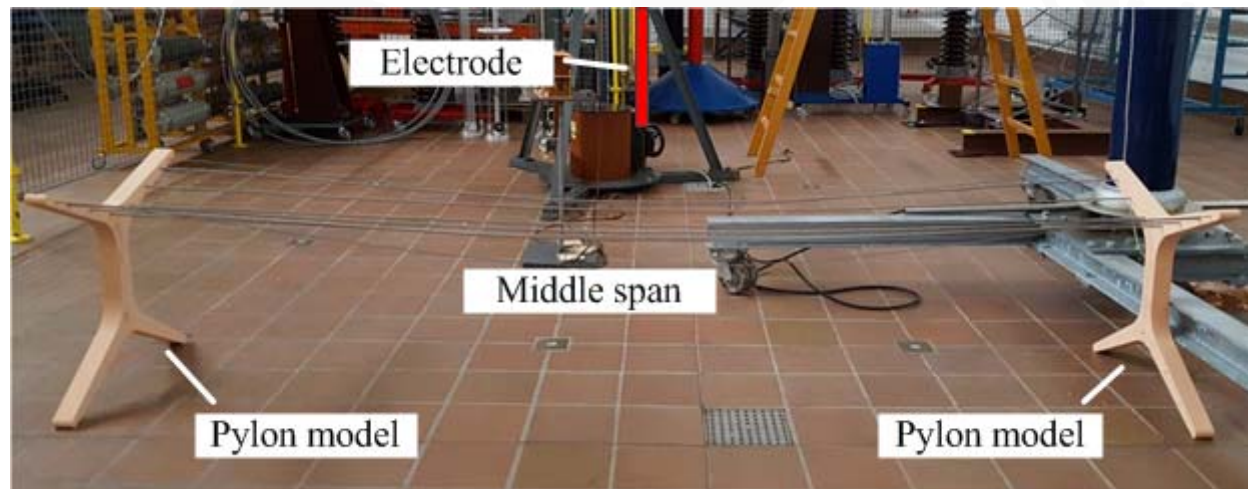
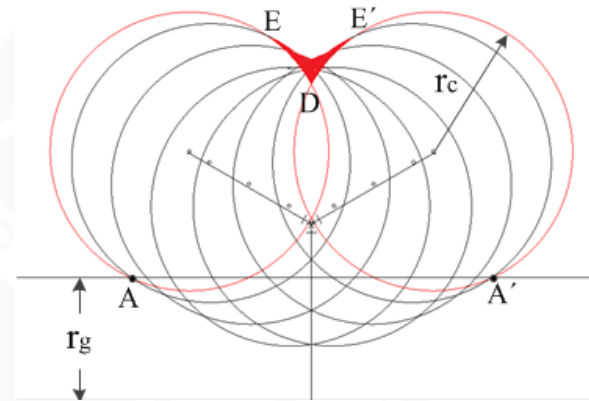
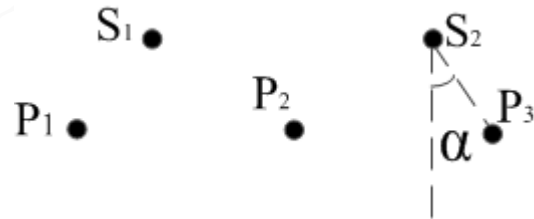
Simultaneous electrical stress and mechanical stress



Fiberglass / epoxy rod made by 'hose' method

## □ Evaluation of lightning performance

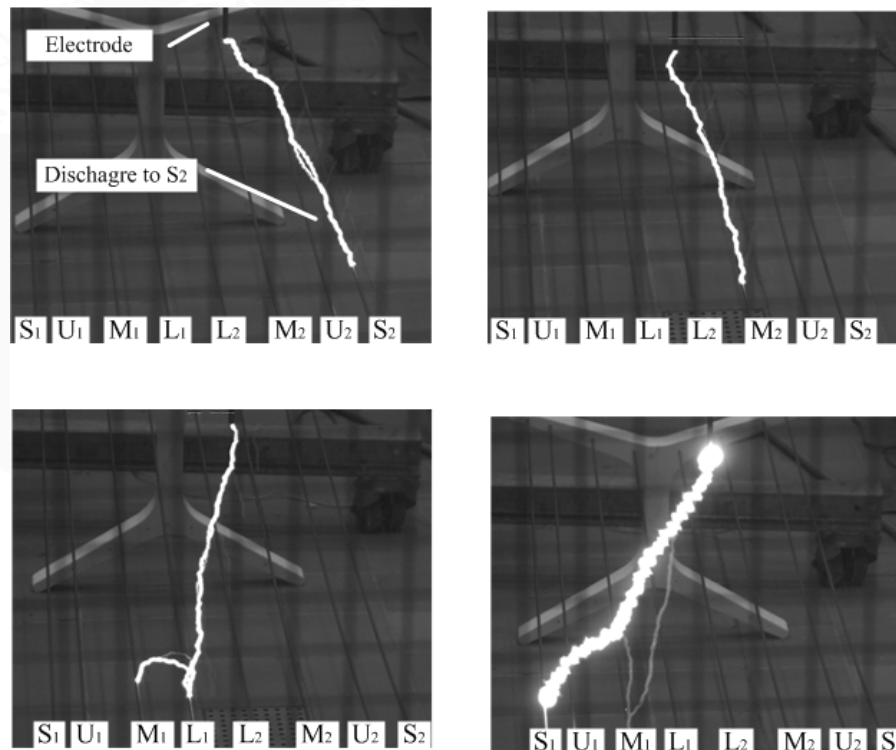
- Electrical-Geometric Model (EGM) method)
- Scale model test



# □ Evaluation of lightning performance



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Photographs taken during scale model test

## ☐ Publications



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[1] Q. Wang, T. Jahangiri, C. L. Bak, F. F. Silva, and H. Skouboe, "Investigation on lightning performance of a novel 400 kv double-circuit composite pylon," IEEE Trans. on Pow. Deliv., (submitted).

[2] Q. Wang, T. Jahangiri, C. L. Bak, F. F. Silva, and E. Bystrup. "A state of the art review-methods to evaluate electrical performance of composite cross-arms and composite-based pylons." IEEE Electrical Insulation Conference (EIC), 2016.

[3] Q. Wang, T. Jahangiri, C. L. Bak, F. F. Silva, and H. Skouboe, "Experimental evaluation of shielding angles' effects on lightning performance in a 400 kV double-circuit composite pylon," International Symposium CIGRE Dublin 2017.

[4] Q. Wang, T. Jahangiri, C. L. Bak, F. F. Silva, and H. Skouboe, "Scale model test on a novel 400 kV double-circuit composite pylon," International Conference on Power Systems Transients 2017.