
The use of an LCD projector for thermal analysis of small objects

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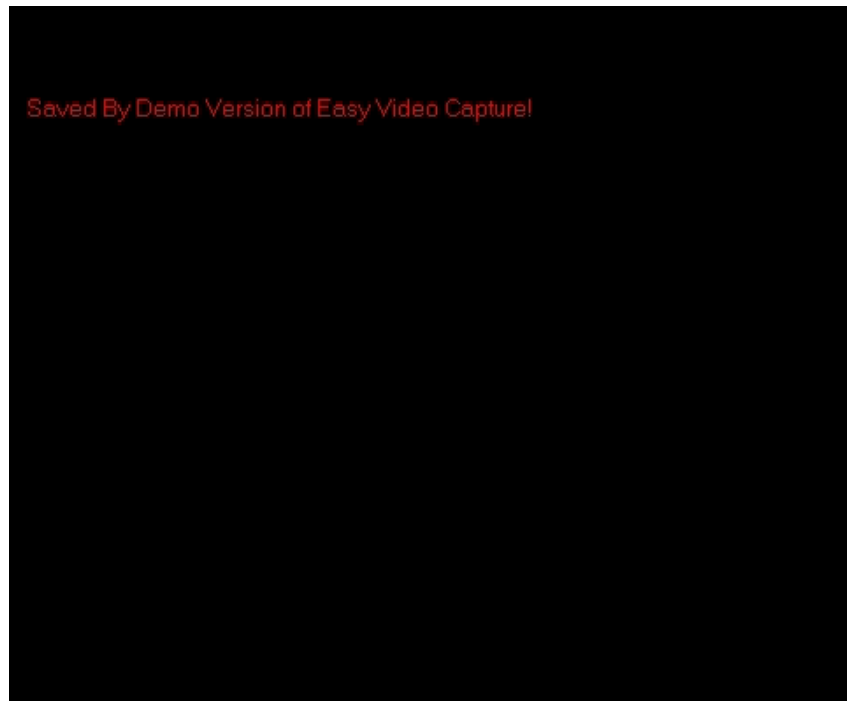
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Basic Idea

- AC analysis
 - Small objects
 - Heat $\sim \cos(\omega t)$
 - How to achieve this?
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- ⇒ LCD projector
 - ⇒ Software

Example of projected image



Experimental setup

LCD projector



sample

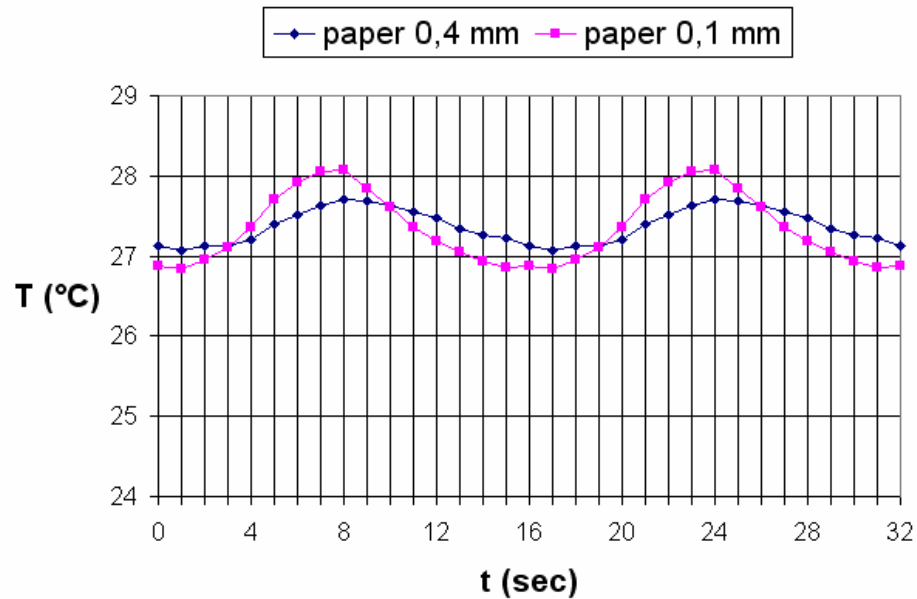


thermographic camera

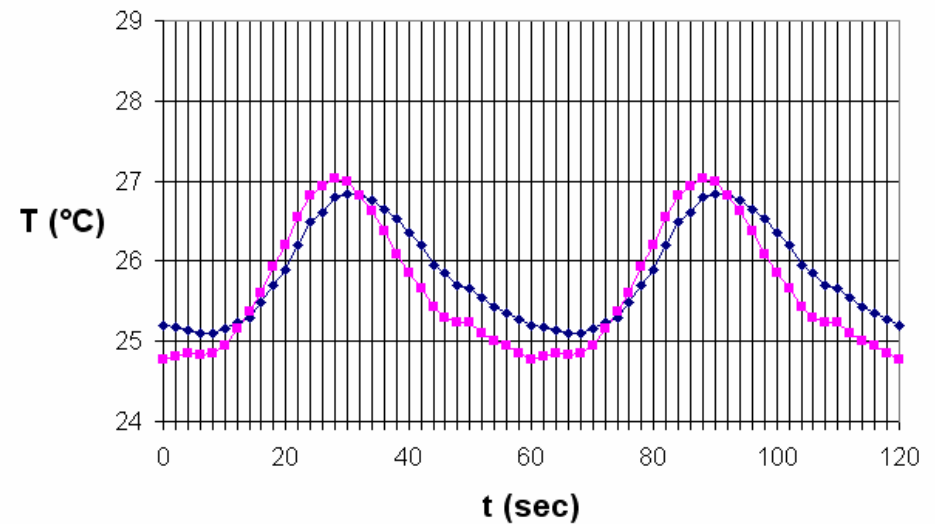


First experimental results

Test objects: paper 0.4mm and paper 0.1mm of thickness



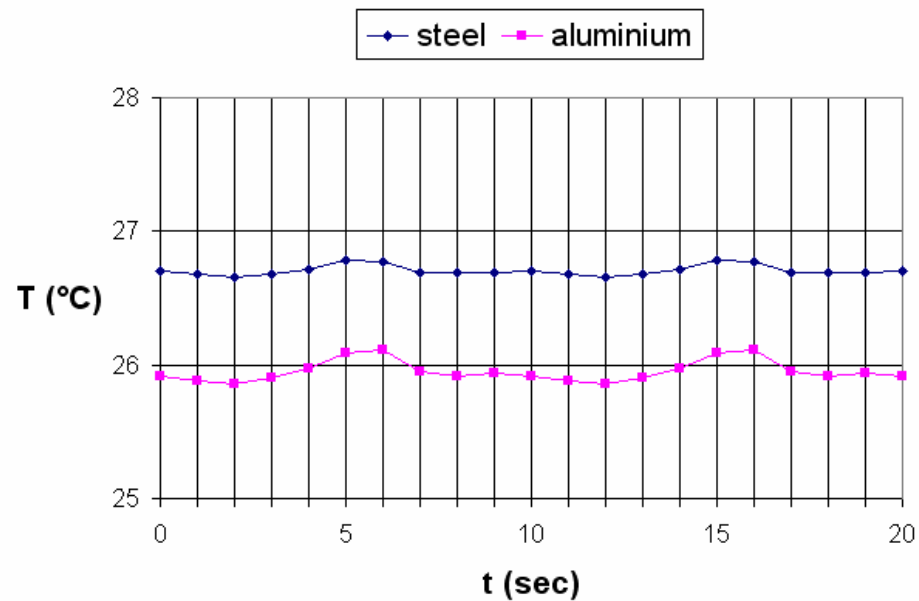
Period = 16 sec; frequency = 63 mHz
Phase shift = 0.393 rad = 22.5°



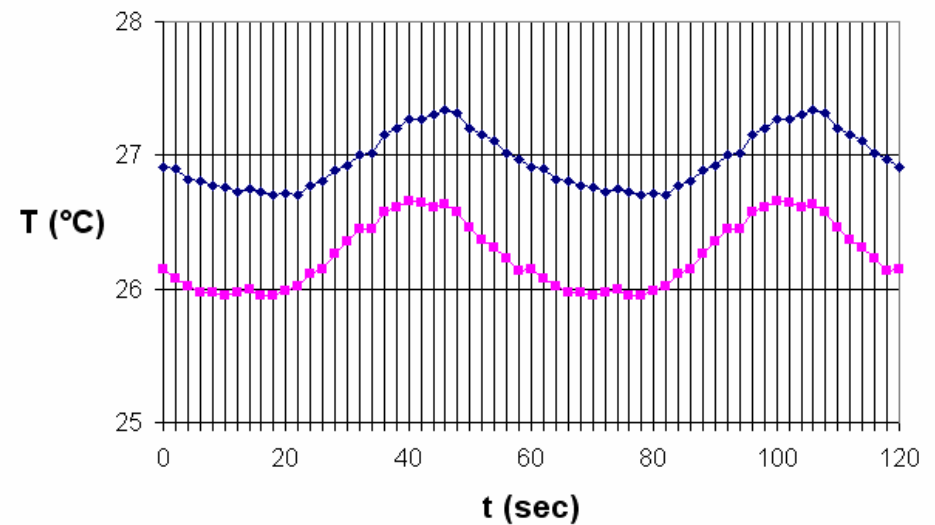
Period = 60 sec; frequency = 17 mHz
Phase shift = 0.314 rad = 18.0°

First experimental results (2)

Test objects: steel (0.4mm of thickness) and aluminium (0.35mm)



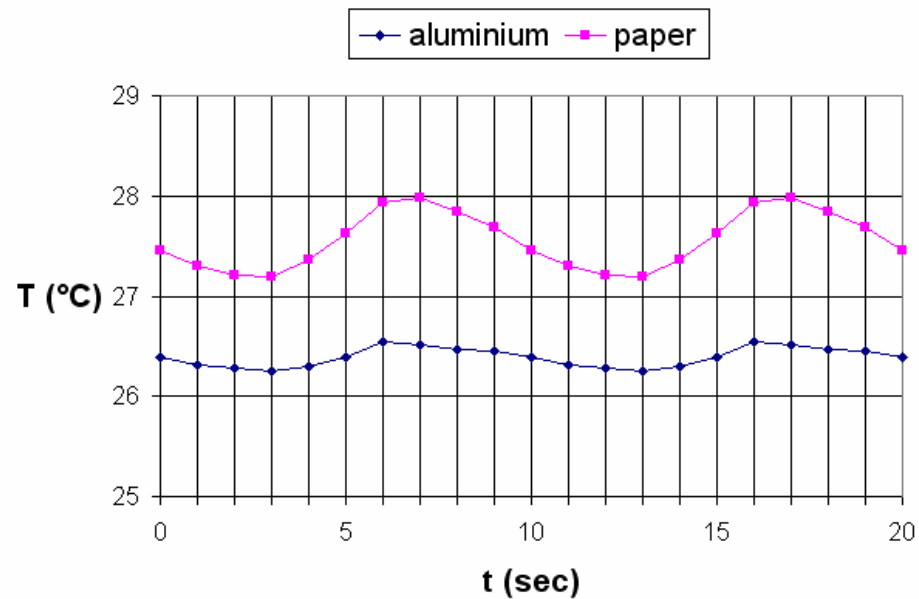
Period = 10 sec; frequency = 100 mHz
Phase shift = 0.0 rad = 0.0°



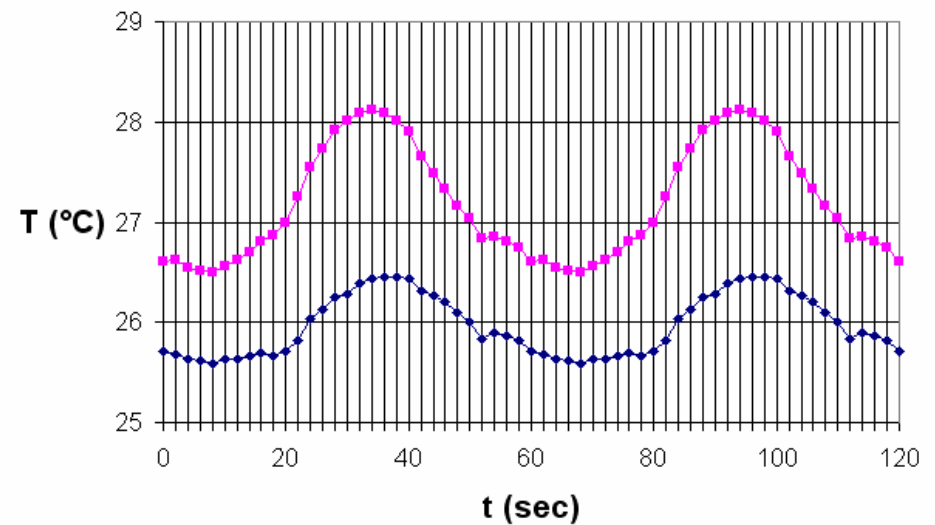
Period = 60 sec; frequency = 17 mHz
Phase shift = 0.262 rad = 15.0°

First experimental results (3)

Test objects: paper (0.1mm of thickness) and aluminium (0.35mm)



Period = 10 sec; frequency = 100 mHz
Phase shift = 0.0 rad = 0.0°

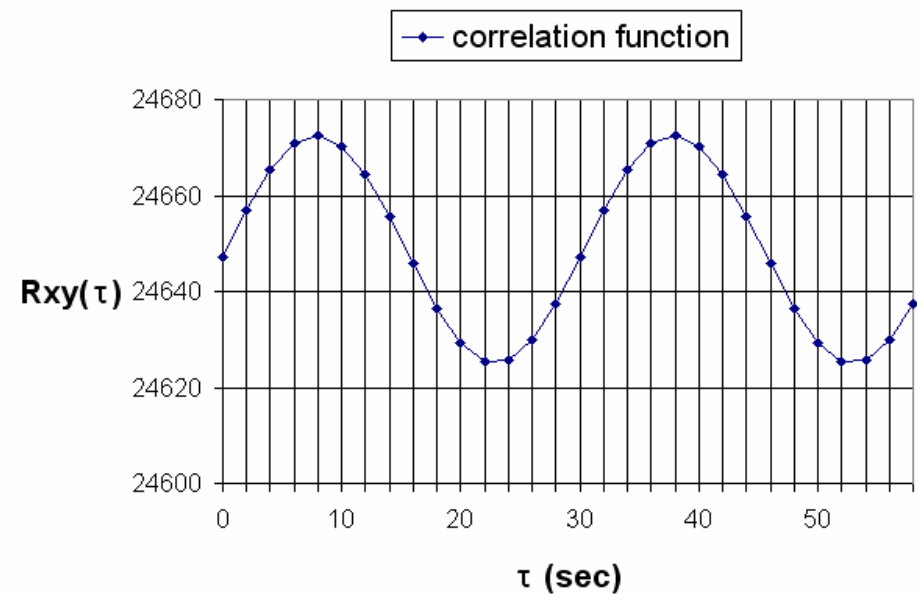
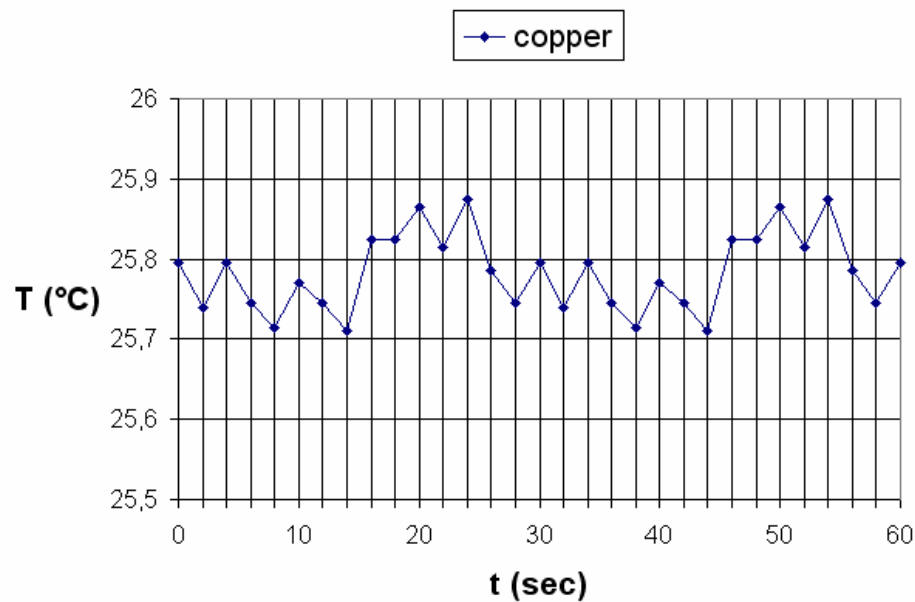


Period = 60 sec; frequency = 17 mHz
Phase shift = 0.105 rad = 6.0°

Correlation

$$R(\tau) = \int \cos(\omega t) T(t + \tau) dt$$

Correlation with input signal ($\cos(\omega t)$) gives clearer result



Test object: copper – 0.83mm

Period = 30 sec; frequency = 33 mHz

Conclusions

- Method works
 - Only first results
 - $\text{heat} = f(t)$ and $\text{heat} = f(x,y,t)$
are both possible
 - Only change software
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