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Absolute Temperature and Emissivity Determination of Heated Materials Using Multispectral IR Imaging and N-Color TES Image Processing

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Monitoring temperature of critical components in the extreme environments found within tokamak reactors presents a unique challenge. Typical contact-based temperature measurement devices such as a thermocouple require the placement of components on the surface to be measured, requiring exposure to the extreme conditions within the plasma vessel as well as potentially disturbing production and maintenance of the plasma itself. Non-contact temperature determination techniques such as two-color pyrometry avoid these issues but are limited to point measurements. Telops is developing an algorithm called n-color TES that extends two-color pyrometry principles to calculate the absolute temperature and emissivity of a multispectral thermal infrared image on a per-pixel basis.

In this work, the Telops MS-M350, a multispectral infrared camera equipped with a fast rotating, 8-position filter wheel was used to collect IBR data on flame-heated materials for preliminary investigations of n-color TES performance. Satisfactory temperature and emissivity separation is achieved for static scenes including the back face of a flame-heated steel plate and a structural composite material. Application of the n-color TES algorithm to a dynamic scene such as the front face of the flame-heated composite material yielded poor results with data collected at low acquisition speeds. An investigation into the origin of this effect is also presented, along with data acquisition guidelines for dynamic scenes.

References

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