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Temperature field reconstruction of flame from images for optimal energy-efficient control of the air-fuel mixture making in steam – driven boilers(Conference Paper)

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Over recent years, substantial efforts have been made to develop technologies for the flame 3D reconstruction and characterization. Among those, the digital image based on tomographic technique has received great attention due to its clear advantages over other approaches. The technology of digital image appeared to be the most suitable for the 3D measurement of flame in practical furnace. Digital image-based tomography of flame can be achieved using either a single camera or multi-camera set-up. Although the single camera approach is simple in structure and low in cost, it can only be applied under strict conditions where the flame is steady and has a high level of rotational symmetry. For the more accurate reconstruction of unsteady and asymmetric flame, a multi-camera system has to be employed. The process of capturing the light from a combustion flame onto an imaging sensor is physically equivalent to a Radon transformation where a 2D flame cross-section undergoes transformation to produce a 1D section projection. Consequently, the reconstruction of a flame cross-section from its multiple 1D projections turns out to be the inverse Radon transformation. Among the majority of currently known multi-camera optical pyrometry methods for temperature field reconstructing, the back-projection algorithm is used for Radon inverse transformation. At the same time, the back-projection algorithm is known to have a low accuracy of restoring the original distribution. The purpose of this report is a study of the algebraic approach possibilities to numerical Radon inverse transformation. We hope that the proposed method can be useful in the process of the 3D image temperature field reconstructing. © Springer Nature Switzerland AG 2019.