

# Third Laureate Invention & Innovation

Scientific Committee  
Electronics & Computer

Research  
Work Title

High Frequency Movement Recording Based  
on Multi-Positioning in a Single Frame (AFRA system)

### Executive Organization

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### Abstract

AFRA system is an innovation in the field of image processing for recording data in laboratory tests and dynamic displacement measurements. This system is based on the new method of multi-position recording in a single frame and provides the possibility of recording the history of object movements with high frequency and high speed for ordinary cameras. This system consists of three parts: an ordinary camera, an AFRA light marker and an AFRA software. By installing the AFRA marker on a moving object, capturing its motions by a simple camera and analysing the film by the AFRA software, the history of the object's motions can be estimated. The idea developed in this invention improves the existing capabilities in the field of image processing and provide the possibility of recording spatial positions at frequencies much higher than the camera is filming frequency. The operation of this system is based on the timing and spatial-temporal control of the AFRA light marker. AFRA optical marker is a hardware that, with the help of an encoded microcontroller, assigns different times of a target point to different spatial positions in the image space. The main achievement of this system is the conversion of an ordinary camera into a high-speed one to record the dynamic movements of the target points. If the main advantages of this system over high-speed cameras are considered, it should be noted that the AFRA system allows video recording for much longer durations of time while maintaining the quality, speed and volume of data storage. In addition, the speed of data analysis in the AFRA system is much higher than that of the videos obtained from high-speed cameras. Other advantages of this system compared to LVDTs, as a well-known tool for recording movement, are also notable; this system does not need a data logger and provides a non-contact motion capturing basis; it has the ability to record the movements of several points simultaneously. Also, its maximum amplitude of recordable displacement can be adjusted; In addition to the ability to record rotational movements, unlike LVDTs, which should touch the body directly, it does not have negative sensitivity to simultaneous displacement in orthogonal directions. The frequency range that can be covered by this system is also much wider than LVDTs.

