

## Development of Scratching Monitoring System Based on Mathematical Model of Unconstrained Bed Sensing Method

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**Abstract :** We propose an unconstrained measurement system for scratching motion based on mathematical model of unconstrained bed sensing method which could measure the bed vibrations due to the motion of the person on the bed. In this paper, we construct mathematical model of the unconstrained bed monitoring system, and we apply the unconstrained bed sensing method to the system for detecting scratching motion. The proposed sensors are placed under the three bed feet. When the person is lying on the bed, the output signals from the sensors are proportional to the magnitude of the vibration due to the scratching motion. Hence, we could detect the subject's scratching motion from the output signals from ceramic sensors. We evaluated two scratching motions using the proposed system in the validity experiment as follows: First experiment is the subject's scratching the right side cheek with his right hand, and; second experiment is the subject's scratching the shin with another foot. As the results of the experiment, we recognized the scratching signals that enable the determination when the scratching occurred. Furthermore, the difference among the amplitudes of the output signals enabled us to estimate where the subject scratched.

**Keywords :** unconstrained bed sensing method, scratching, body movement, itchy, piezoceramics

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