Muscle Force Exploration through Simulation for Passenger Seat Design

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Abstract - Along with recent advancement, many automobile industries have strongly encouraged research on their product design, structure, consumer comfort and ergonomics and so on. In particular, consumer satisfaction or human comfort is playing an important role including seat comfort, driving posture, visibility, interior space, etc. In general, sitting in an automobile seat for prolonged period can cause back pain or worsen an existing back or neck problem. This study performed the simulation to explore muscle force during prolonged period of sitting for passenger seat design. The trapezius muscle forces have been measured from the simulation and compared for the different backrest inclination angle and sitting period.

Keywords: — sitting posture, back pain, muscle force, ADAMS/LifeMOD

1 Introduction

The automobile is not only as a transportation for humans, but also have a very close relationship with humans as the entertainment or work tools, recently, depend on rapidly development of the sciences, the automobile's performance has been greatly improved, and with the development of economic the consumer culture also has a qualitative change, the consumers pay more attentions to the comfort of driving, therefore, how to improve the comfort of the automobile become a hot topic in the field of automobile industry.

The comfort and fatigue of driving depend on the road, driving speed and time, driving posture or sitting position and the cushion device of the seat, as the related research on the driving posture, Rebiffe,1969[1] had a undertook study about when the each joint of our body in some angle is the best driving posture, obtained a relationship of the driving seat and pedal that applies to various height driver, although the results of the seat angle range is too big, and the angle is actually a 2D parameters rather than the 3D parameters that actual seat design to be used, but the results are very valuable for the seat designers as some design basis. Verrirst,1986[2] introduced a kind of adjustable experimental device that can measure the variable parameters of driving posture, and Schneider’s,1979[3] studies tell us, driving posture, the position between the seat and steering wheel is a complex interactional influence for the comfort. In South Korea, for the automobile seat that suitable for Koreans shape also have some related research Se Jin Park,2000[4] using statistical method to derive the standard of the driving posture Sung Jun Park,2006[5], as described above, although there are many researches for the driving posture and fatigue, But this field is currently in a chaotic state, therefore, is very necessary to study the factors that affect the riding or driving comfort, especially in the premise of ensuring the driver or passengers’ safety, how can to provide the comfortable riding feeling to the driver and passengers, and lifting the fatigue of riding the automobile. It is still need to be very large and complex research to solve these problems.

Recently, many software applications have been developed for impact simulation, biomechanical analysis, movement simulation and surgical planning. The software enables users to perform human body modelling and interaction with environment where the human motion and muscle forces can be simulated.

While studying the muscle force when driving, a man-automobile system simulation model is needed. In this study, a dynamic model created which contains passenger model and
a passenger’s seat. The human modeled with South Korean characteristics, which contains skeletons, muscle, ligaments and joints. With this dynamic model simulated the process of passenger’s driving. The simulation has been performed to explore the muscle force, when the backrest at different angles.

3 Discussion

With the simulation results, comparative analyses have been performed. Through analyzes, the relationship between the comfort level and the backrest inclination angle have been found. We wish the values and results will be useful for the bus passenger’s seat design.

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5 References


