

Relationship between Kansei Evaluation and Physical Characteristics of Haptic Switches

Hajime Yasuda ¹⁾ Tomotaka Igarashi ¹⁾ Akinari Hirao ²⁾

¹⁾ Nissan Motor Co., Ltd.

560-2, Okatsukoku, Atsugi, Kanagawa, 243-0192, Japan (E-mail: yasu@mail.nissan.co.jp)

²⁾ National Institute of Advanced Industrial Science and Technology (AIST)

1-1-1 Higashi, Tsukuba, Ibaraki, 305-8566, Japan

KEY WORDS: Human engineering, Human machine interface, Haptic sense, Operation force, Acceleration (C2)

Many kinds of switches are used inside the cabin. Recently, the switches without stroke tend to be used by technology advances and styling demands. In this study, the evaluation structure of operation feeling and the switch characteristics were analyzed for haptic switches that are the new type of push switches operating by finger.

Operation feeling of the switch is determined by mechanical properties transmitted to finger and mechanical sound. Mechanical switch can be represented by F-S diagram (Fig.1). On the other hand, haptic switch can be represented by F-t diagram, because it doesn't have stroke (Fig.2).

Based on the results of principal component analysis, the relationship between the components of quality feeling and the characteristics of vibration is summarized (Fig.3 and 4).

Nine operation feelings were quantified to formulas. Finally, operation feeling characteristics and perception mechanisms of operation feeling were discussed in the paper.

- a : Push operation force [N]
- b : Release operation force rate [%] (= release / push)
- c : Displacement [μm]
- d : Acceleration [G]

Click feeling	=	0.144a + 0.004b - 0.0006c + 0.506d + 0.903
Smooth feeling	=	- 0.030a + 0.012b - 0.0017c + 0.177d + 1.951
Effort feeling	=	0.218a + 0.001b + 0.0023c + 0.375d + 1.118
Solid feeling	=	0.187a + 0.002b - 0.0025c + 0.307d + 1.532
Stroke feeling	=	0.143a + 0.003b + 0.302d + 1.726
Feedback strength	=	0.195a + 0.002b + 0.0039c + 0.345d + 0.701
Ease of understanding	=	0.090a + 0.003b - 0.0006c + 0.358d + 1.791
Quickness of feedback	=	- 0.059a + 0.009b - 0.0021c + 0.152d + 2.185
Senses of incongruity	=	0.095a + 0.012b - 0.0008c + 0.319d + 1.128

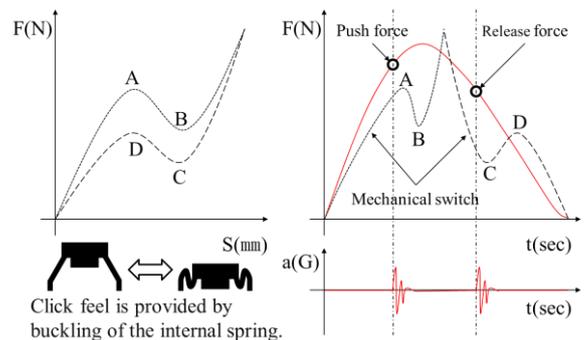


Fig.1 F-S diagram of mechanical switch

Fig.2 F-t diagram of haptic switch

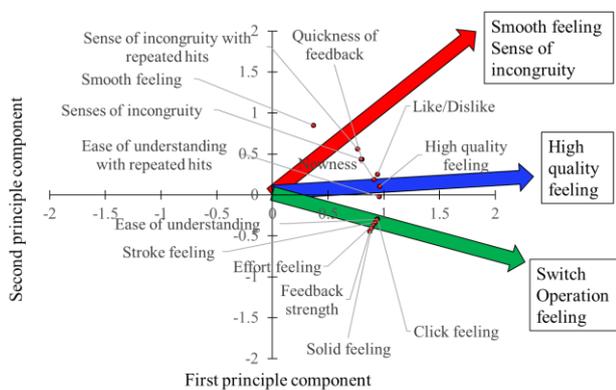


Fig.3 Factor of the operation feel

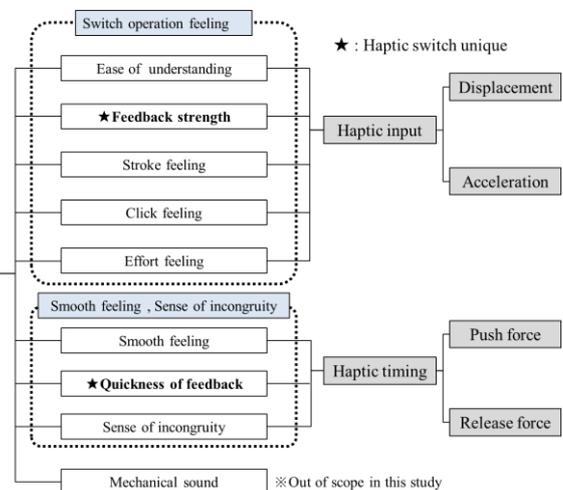


Fig.4 Functional deployment of quality feeling for haptic switch