Seismic isolation system for furniture

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Recently, seismic isolation systems are used many as an earthquakes measure for high-rise buildings. Then I thought that I wanted to show the good effects for tall furniture so I started this study.

According to Teraya and etal. (2015), the two bookshelves as shown in Table.1 turn over at 0.6Hz and 1.0Hz when the flooring is carpeted and in the case of flooring, acceleration tends to increase at 0.6Hz. So, the frequency that tall furniture falls easily is from 0.6Hz to 1.0Hz.

In this study, I used a seismic isolation system which replicated soft material and hard material. I thought that if an earthquake frequency is reduced them, furniture would not fall. This study’ s goal is to find materials which can do that.

I used two kinds of seismic isolation systems as shown in Table.1. I put four seismic isolation systems under two different models of tall furniture. This is shown in Fig.1.

I measured acceleration with three smartphones like Fig.1 using the application: “Acceleration Logger” by Naoki Kisara. I moved the experimental equipment in the direction of the arrow in Fig.1, and used the Fourier formula to convert the data which I measured on each model. Then I made graphs of the magnification of the magnitude of the quake. I divided one data which one model used my seismic isolation system by another data didn’ t. This is shown in Fig.2.

In Fig.2, when magnification of a certain frequency was more than 1, I substituted +1 for the frequency and if it was less than 1, I substituted -1 for the frequency. I measured them 30 times in this way. Fig.3 is the graph of the total of the values that I substituted for every frequency.We call this way SS method “Sign Sum”.

In the case of seismic isolation system 2, magnitude of the quake is reduced at 1.0Hz. This combination shows the good effect for tall furniture around 1,800 millimeters.

In the future I want to look for a better material or combinations from the viewpoint of hardness of the material.

Keywords: earthquake, seismic isolation system, furniture

表 1.家具と免震装置の詳細

Table.1 Details of furniture and seismic isolation system.

	寸法(mm) (幅×奥行き×高さ)	質量(kg)	備考	出典
本棚 1	900×300×1800	32.0	棚板耐荷量 20kg 地板は転倒防止の為 80mm 前方に突出	寺屋・他 (2015)
本棚 2	450×290×1800	18.5	棚板耐荷絵量 10kg	寺屋・他 (2015)
免震装置 1	50×50×25	0.1	2.0mm のゴム＋0.5mm のアルミ	本研究
免震装置 2	50×50×25	0.04	2.0mm の発泡 P.P＋0.5mm のアルミ	本研究

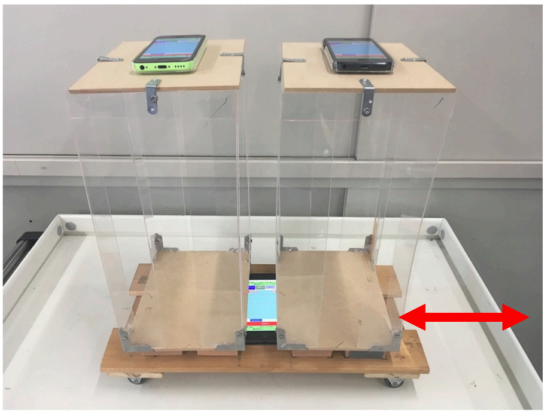

図 1 .家具の模型として作った実験装置

Fig.1 Experimental equipment which was made as models of furniture.

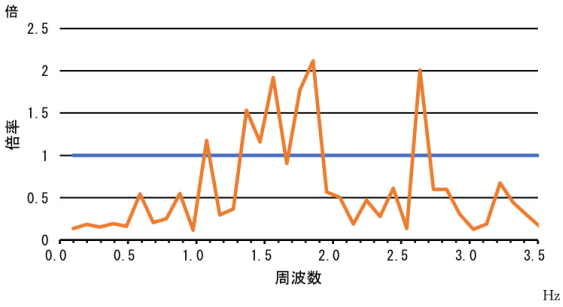

図 2 .免震装置を使用していない方に対する、

使用している方の加速度の倍率のグラフ(例)

Fig.2 Example of graphs of the magnification of the magnitude of the quake.

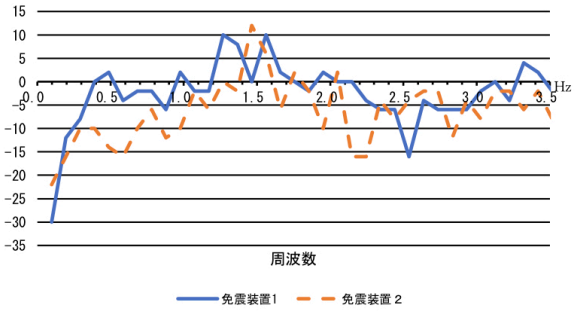

図 3 .SS 法で集計した結果

Fig.3 Graph of counting by SS method.