

摘 要

我国有 2000 多万听力语言障碍者，他们个性突出，是需要国家和全社会关心和帮助的有特殊困难的群体。手语是听力语言障碍者最重要的交际手段。如何有效地表现手语，推进手语的规范化，实现手语的普通化，是创建聋人-健听人共融的无障碍环境的关键问题。目前虚拟人合成技术越来越成熟，并主要集中在生成逼真的虚拟人模型和研究逼真、方便、自然的虚拟人运动控制方法上，这正好为手语的表现提供了很好的方法。国际上多采用基于视频的方法来表现各国的手语，这不仅难于准确表现复杂的手语，也不易于传播。而基于三维虚拟人的手语表现方法也在近期才应用于美国手语。如何实现面向中国手语表达的虚拟人合成技术和如何用这种技术很好地合成和表现中国手语，这在国内外尚还没有成熟的研究。本文首先研究实现虚拟人合成技术，然后建立面向中国手语表达的虚拟人合成平台，最后基于这个平台，研究实现中国手语合成方法。

本文在三维虚拟人模型的表现、个性化虚拟人模型骨架生成、三维虚拟人姿态控制与运动合成、中国手语运动数据库、中国手语合成方法等关键问题上展开研究，同时基于这些成果，实现了中国手语合成的一整套原形系统，包括手语运动的数据系统、手语运动的编辑系统、中国手语合成系统，在此基础上，实现了面向学校的手语教学系统、面向电视台和面向互联网的手语新闻、面向交流的双语对话系统等一整套中国手语应用系统，以此帮助聋人与健听人之间实现自然交流以及促进中国手语的推广应用。

关键词： 虚拟人合成；中国手语合成；虚拟人模型；运动控制；虚拟主持人

Research on Chinese Sign Language Synthesis with Virtual Human Synthesis Technology

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In our country, there are more than 20 million hearing disabled people. They are special social vulnerable groups with conspicuous individualities and request the care and help of whole country and society. As we know, the sign language is the most important intercommunication measurement to hearing disabled people. However, how to communicate effective in sign language, how to promote the standardization of sign language and how to implement the popularization of sign language, are the crucial problems to construct the deaf-general and barrier-free environment. With the virtual human synthesis technology becoming more and more mature, especially, the development of generation the living virtual human model and the achievement to obtain realistic, convenient and unaffected motion control methods of virtual human, lots of techniques support precisely the representation of sign language. In this field, the video-based method is the common measure to represent the different sign languages, however, it is very difficult to represent accurately the complicated sign language using this method, moreover, it is very hard to popularize. Recently, the method based on 3D virtual human was applied to represent the American Sign Language. In China, however, there are still not mature researches to synthesize and implement the representation of Chinese Sign Language using the technology of 3D virtual human. In this research, we first studied and accomplished the technology of virtual human synthesis, and then we established the platform of virtual human synthesis for Chinese Sign Language, we, finally, developed a method to synthesize of Chinese sign language based on the platform.

This dissertation researched some key problems in sign language synthesis, such as the representation of 3D virtual human model, the construction of individualized skeleton of virtual human model, the gesture control and motion synthesis of virtual human model, the gesture database of Chinese sign language, and the method of synthesis Chinese

sign language. Based on above achievements, we develop the all set of original system for Chinese sign language synthesis, including Gesture Record System, Gesture Edit System, and Gesture Synthesis System. Based on these, we developed the sign language education system to the school, the news system using sign language to TV and Internet, the bilingual dialogue system to the communion and the all set of the applying system of the sign language application system. These researches and systems consequently help to implement the natural communication between deaf and General Men, and promote the popularization of Chinese sign language.

Key words: virtual human synthesis, Chinese sign language synthesis, virtual human model, motion control, virtual Avatar