

Lower-limb exoskeletons can be worn to provide personalized rehabilitation by assisting or resisting an individual's walking by providing external torques, or force, at the joints. I aim to investigate the effects of wearing a resistive ankle exoskeleton (torque opposing the user) on muscle activity and walking kinematics to provide insight as to how these wearable devices may impact rehabilitation. The level of exoskeleton torque that a user may receive is arbitrarily chosen based on a brief visual analysis of the user while they walk with the device. While this can prove effective for some individuals, there are alternative methods by which the devices may be controlled. Additionally, walking with a wearable exoskeleton greatly influences walking kinematics, or how an individual's joints move while walking, and it is difficult to predict how a user may adapt their kinematics given a set exoskeleton torque. Thus, there is a need to analyze the state-of-the-art control mechanisms and look for alternatives as to how to approach exoskeleton control. With this in mind, my project aims to accomplish this with a thorough literature review and critical review of peer-reviewed work and then propose a future research direction.

My information search for this literature review began by finding a review paper on exoskeleton control, followed by an examination of the authors' insights into future research directions and recent citations. I then proceeded to categorize these articles based on their focus, distinguishing between review papers, methods-focused papers, and evaluation-focused papers. As I developed a more specific direction of interest, particularly focusing on system identification, my research approach evolved. Once I gained a comprehensive understanding of current control strategies and exoskeleton mechanics, I narrowed my focus to peer-reviewed articles discussing specific exoskeletons and emerging control methods focused on system identification. This shift allowed me to identify gaps in the literature and refine my research direction. Through this experience, I learned the importance of beginning with a broad overview of the field and subsequently narrowing down my focus to address specific research gaps. This iterative process informed my future work by guiding me in identifying and addressing pertinent research questions in the field of exoskeleton control and how system identification may contribute.

In sourcing information for my project, I employed a varied approach to comprehensively explore the ongoing research related to my topic. Initially, I used vocabulary acquired in my coursework to guide my search for relevant peer-reviewed articles, leveraging resources such as the UW library database and Web of Science. Review papers served as invaluable tools in narrowing down related fields and identifying key authors pertinent to my project. However, I encountered challenges, particularly in accessing information on system identification and lower-limb exoskeleton control strategies, which were both incredibly important topics for my research. To overcome these obstacles, I relied on review papers to identify specific, well-known authors and journals with relevant publications. In instances where gaps persisted, I revisited comprehensive review papers and sought assistance from librarians through the UW Librarian online chat resource to identify additional peer-reviewed journals relevant to my work. While continuing to use specific search techniques and vocabulary, including keywords like "exoskeletons," "system identification," and "nonlinear control," I also delved into related literature encompassing "prosthetics," "linear control," "gait analysis," and "kinematics" to gain more insight into translational fields related to my topic. I transitioned to critically analyzing primary source peer-reviewed recent publications from peer-reviewed journals with high impact factors to find strong examples of related work. In exploring research tools and techniques, I found starting with review papers helpful for summarizing ongoing research and narrowing my focus. Certain journals specialize in content relevant to my project, guiding my search for pertinent articles. The UW Libraries' Web of Science tool deepened my understanding of the literature and aided source selection, and using library resources like the UW

Libraries' database, online consultations with librarians, and interlibrary loan services for articles I did not have access to greatly aided my research process. These strategies ensured that I had a strong foundation for my research, allowing for a comprehensive understanding of my discipline and facilitating informed insights into my topic.

My search efforts helped me develop a strong understanding of my specific field and its broader contexts. My search strategy, as well as the assistance I received with UW Libraries and their resources, helped me understand the relevant literature for my field and identify key sources, including review papers, recent publications showcasing novel techniques, and obscure yet informative content from published books or lesser-known journals. These strategies helped me identify purposeful areas where my project should focus investigation in, thus helping me develop a focused and concise literature review. Overall, the resources and methodology I used helped me develop independence in my research for project and prepare a high-quality deliverable that I can use to guide future coursework or related writings.