Dynamic modeling of a rescue robot for real-time response

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Abstract

Depending on trend of unmanned combat systems, a rescue robot which saves the injured from inaccessible areas has been developed. Because the rescue robot will be driven on rough terrain, it can be gotten a large response. Due to the severe response, it may give severe impact to the injured. In addition, when the rescue robot might be operated by a remote control, it is difficult to respond quickly to dangerous situations. In order to pursue the stability of the rescue robot, an algorithm which calculates the stable speed is required.

As shown in Figure 1, the rescue robot is composed of the body, the manipulator and track parts. Although the track consists of many parts, it should be simplified to get real-time response. So the lumped track model was applied, in which a proper accuracy is achieved with a small amount of elements. This paper conducted the lumped track modeling to calculate the track element force as shown in Figure 2. And Bekker's equation was employed to express relationship between pressure and sinkage of soil as shown in Equation (1).

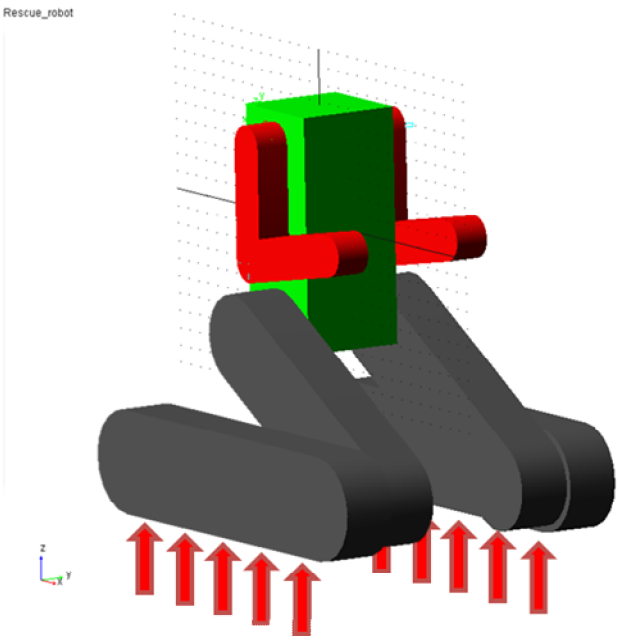

Figure 1 : Rescue robot

$$p = \left(\frac{k_c}{b} + k_\phi \right) z^n \tag{1}$$

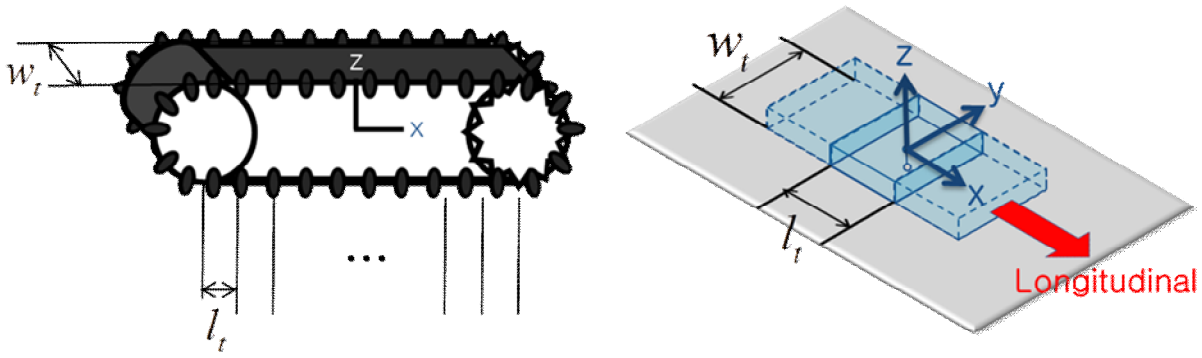

Figure 2 : Distribution of track

Where p is the pressure under the track, b is small dimension of contact patch, w_t is the track width, l_t is the track element length, and z is the sinkage of soil. And k_c , k_ϕ are soil modulus of deformation to show the property of pure soil, which are measured by bevameter.
This paper shows a possibility about the real-time response estimation by performing the rescue robot modeling applied this lumped track model.

Acknowledgments

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