ABSTRACT
When stationary, gravitationally upright human subjects undergoing optokinetic stimulation experience yaw circularvection and then make a pitch or rolling head movement, they describe strong paradoxical tumbling and tilt sensations resembling vestibular Coriolis Effect (CE). Brandt and Dichgans [1,2] referred to this as a “Pseudo-Coriolis Effect [PCE], noting that “a model that would explain the pseudo-Coriolis effects entirely, including the surprising conformity of direction of the illusory tilt in CE (Coriolis Effect) and PCE (Pseudo-Coriolis Effect) cannot yet be proposed.” These and several subsequent studies [3,4] compared the nauseogenic properties of PCE as compared to CE, and noted that CE and PCE effects appeared qualitatively similar. We recently applied Merfeld’s et al’s “Observer” model for vestibular cue integration [5,6] to predict CE when subjects make head movements during prolonged physical rotation in darkness. We confirmed that vestibular CE follows a positive vector cross product (“right hand”) rule, e.g. during clockwise rotation, a clockwise head roll produces a pitch backward sensation [e.g. 7]. We then [8,9] extended the Observer model to include optokinetic angular velocity and visual “down” cues, and ran PCE simulations. The extended model incorporates a 3D visual-vestibular angular velocity storage-like mechanism. It predicts that -- as proposed by Guedry [10] and Bles [3] -- vection perception initially moves with the head, producing tumbling and tilt sensations analogous to “Purkinje” (aka Dumping) vestibular illusions. However, we emphasize that, unlike vestibular CE, optokinetic PCE sensations actually follow a “left-hand-rule,” e.g. during clockwise vection, a clockwise roll produces a pitch forward illusion. Also, unlike CE and Purkinje illusion, vection continues, but paradoxical PCE tumbling and tilt components disappear as the vection axis gradually realigns with visual and gravitational stimuli. We experimentally confirmed the CE/PCE direction difference in a group of human subjects. Supported by the National Space Biomedical Research Institute through NASA NCC 9-58.

REFERENCES