DIFFERENTIATING MANIFESTATIONS OF SOPITE SYNDROME AS PRODUCED BY INERTIAL MOTION AND VECTION. Brittany N. Neilson & J. Christopher Brill, Department of Psychology, Old Dominion University, Norfolk VA 23529. Sopite syndrome is a polysymptomatic manifestation of motion sickness that presents itself as marked drowsiness despite receiving an adequate night’s sleep, relaxation, and lack of motivation. Previous studies evaluate sopite syndrome using either a motion device or a vection device. The present research aims to differentiate the symptoms of sopite syndrome produced by actual motion versus perceived self-motion (i.e., vection) in order to better identify the psychophysiological markers of sopite syndrome. Twenty-five undergraduate psychology students participated in the pilot study. An analysis of covariance was used to evaluate participant’s self-reports on motion questionnaires, physiological measurements, and brain activity across three motion conditions (inertial motion, vection, and control) holding traits of sleepiness and motion sickness constant. Participants in the motion condition reported increased symptoms ($M = 20.75, SD = 23.95$) compared to participants in the vection ($M = 8.53, SD = 25.45$) and control conditions ($M = 5.53, SE = 24.25$), but this effect was not statistically significant at $p < .05, F(2, 19) = 2.87, p = .081, \eta^2 = .20$, due to insufficient sample size. Implications for future research will be discussed.

SEGMENTATION OF INTERFACE PRESSURE MAPS: THE USE OF A CONNECTED ELLIPSE MODEL TO IDENTIFY AREAS AT RISK FOR PRESSURE ULCER DEVELOPMENT. Anath ea A. Pepperl and Paul A. Wetzel, Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. Mary Jo Grap, Department of Adult Health and Nursing Systems, Virginia Commonwealth University, Richmond, VA 23298. In order to study pressure ulcer development, it is useful to analyze pressures at specific high-risk areas, or regions of interest (ROIs). A contour-based connected ellipse model was used to segment ROIs. A user selected the approximate centers of ROIs. An Expectation-Maximization algorithm refined the center locations and defined an ellipse at each ROI. The connected ellipse model was then iteratively refined so as to minimize (1) the distance between connected ellipses and (2) the distance between the image contour and the edge of the closest ellipse. Ten pressure images were collected from four patients in intensive care units at the Virginia Commonwealth University Health System (VCUHS). The distance between ROI peak pressures generated by automatic and manual segmentations was defined as the error. The average errors (in inches) for each ROI were: 6.64, left scapula; 7.76, right scapula; 4.54, left trochanter; 5.31, right trochanter; 0, left heel; 0.85, right heel. The average error was 4.18 inches. Visual inspection showed that this error was caused by the peak pressure lying just beyond the contour of the ellipse. The connected ellipse model is an effective method for segmenting pressure images. The model may be further refined through the inclusion of intensity data.
DEVELOPMENT OF A NOVEL BLOOD ANALOG WITH PHYSIOLOGICAL SHEAR-THINNING AND VISCOSITY CHARACTERISTICS. S. J. Warren, C. E. Taylor, and G. E. Miller, Dept. Biomedical Engineering, VCU. Mock loops are a integral part of the testing and evaluation of cardiac assist devic. In order to obtain near physiological data in a mock circulatory loop, a compressive fluid similar to human blood is needed. This project will test the properties of an oil base fluid, in order to match the viscoelastic properties of Human blood. The work presented was based on the following research questions: Does the oil based fluid show shear thinning properties closest to those of human whole blood? Does the oil based fluid correlate with the viscoelastic curve of human whole blood better than other blood analogs currently in use? All viscosity data was collected on an Anton Paar Rheometer with a parallel plate and 500 micron gap. The test was a shear sweep from .001 to 10001/s. The work presented two candidates; one that is optical clear and the other is rheological more accurate. The components are pure and commercially validated for mechanical properties, which releases the end user from having to revalidate the constructed solution. Choice of fluid construction was designed to prevent large dilution factors, to provide a robust method for fabricated a shear-thinning blood analog for cardiac assist device evaluation.

CONTROL MODEL AND PERFORMANCE OF A COMPLIANCE CHAMBER FOR SIMULATING ARTERIAL SYSTEMIC COMPLIANCE. C. E. Taylor and G. E. Miller, Dept. of Biomedical Engineering, VCU. Utilizing mock circulatory loops as a bench test method for cardiac assist technologies provides that the system must be capable of reproducing the circulatory conditions that would exist physiologically. Of particular interest is the ability to determine compliance delivered by the system, and the ability to change the compliance in real-time. The latter capability allows for continuous battery testing of conditions without stopping the loop operation when changing the compliance chamber settings. The compliance chamber presented utilizes a natural latex rubber membrane separating the fluid and air portions of the device. Change in system compliance is affected by the airspace pressure, which creates more reaction force at the membrane to the fluid pressure. A pressure sensor in the fluid portion of the chamber and a displacement sensor monitoring membrane position allow for real-time inputs to the control algorithm. A predefined numerical model correlates the displacement sensor data to the volume distention of the membrane. The PI controller tuning was achieved by creating a computational model of the compliance chamber using Simulink Simscape toolboxes. It was found that the resulting control architecture was capable of maintaining a compliance set point, and allowed for changes to the compliance without stopping the pulsatile flow of the mock circulatory loop.

THE EVOLUTION OF AN EVENT DETECTION ALGORITHM. Pallavi Ramnarain and Dr. Paul A. Wetzel, Dept. of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA. The purpose of this presentation was to explore the methodological processes behind the development of event detection algorithms. Signal acquisition imposes the first set of limitations on event detection. After that an iterative process is initiated. The first step is to identify the event of interest. Then it must be defined using finite, quantitative characteristics that
distinguish it from the remainder of the signal. Then an approach to detection can be
developed. The approach must be validated and then separately evaluated for its
accuracy. Limitations are identified and quantitatively defined, and so the process
continues. To illustrate this example data from a study examining preterm infant
bottle feeding competency was used. The focus was placed on the detection of bottle
sucking activity. Multiple approaches to event detection were explored.

A Patient Specific Computational Model of Adult Acquired Flatfoot
Deformity. E.M. Spratley & J.S. Wayne, Dept. of Biomedical Engineering &
Orthopaedic Surgery, VCU, Richmond, VA 23284. Computational modeling
offers advantages over MRI and plane-film x-ray alone in the quantification of adult
acquired flat foot deformity, (AAFD). As such, a population of solid body models
was created for the purpose of replicating common radiographic tests used in the
quantification of degenerating flat foot morphology. This was accomplished by
acquiring a sample of sub-millimeter resolution MRI scans from a group of
clinically diagnosed Stage II AAFD sufferers prior to surgery. The scans were
imported into the medical imaging package, Mimics (Materialise, Ann Arbor MI),
wherein the bony surfaces were isolated from the surrounding tissues and
triangulated to form a solid bodies for each bone in the foot. Subsequently, the
bodies were imported into SolidWorks (SolidWorks Corp., Concord MA) and
templates recreating an oblique anteroposterior film x-ray view were constructed.
This template allowed the talo-1st metatarsal angle (T1MT) and talo-navicular
coverage angle (TN) to be calculated for each of the AAFD models as well as a
non-flat foot cadaver-based model that served as the control. The normal model
had a T1MT=5.35° and a TN=0.76°. The AAFD models had a mean T1MT=8.28
±1.66° and a TN=5.15±4.65°. While these values are lower than those in the
literature for T1MT and TN, the values for T1MT were within ranges reported
clinically. Additionally, the sample set was able to capture the characteristic
increase in the two angles for AAFD feet over those of non-afflicted feet. Further
refinement of these models could lead to better classification of AAFD patients with
the ultimate goal of improving the treatments prescribed.

Botany

Growth and Nutrient Accumulation Responses to Phosphorus Deficiency in Cellulose Synthase Mutants of
Arabidopsis thaliana. Rob Harbert, Roanoke College. Cellulose synthase
mutants of Arabidopsis thaliana are affected not only in the overall amount of
 cellulose they are able to produce, but also in the carbohydrate composition of their
cell walls. These alterations in the composition of the cell wall may also impact
the functions of other components of the cell wall and plasma membrane. The
cellulose synthesis mutants JE100, rsw1-1, and prc1, as well as the Columbia and
Wassilewskija (WS) wild types, have been used to see if changes in cell wall
composition have any effect on how these mutants perform in phosphorus deficient
conditions. The results indicate that JE100 plants respond differently to