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Editorial

40th Anniversary Issue: Reflections on papers from the archive on "Rehabilitation Engineering"

Rehabilitation engineering in the broadest sense concerns the application of engineering principles to the study of musculoskeletal system with a view to developing technological solutions and devices that assist individuals with disabilities, and which may aid in the recovery of physical and cognitive functions lost as a result of congenital conditions (e.g., cerebral palsy), disease progression (e.g., stroke or joint replacement surgery) or trauma injury (e.g., limb loss). It ranges from direct observation of how individuals perform specific tasks and making accommodations with a view to eliminating further injuries and discomfort, to more sophisticated interventions through the use of functional electrical stimulation, robotic devices and neuroprosthetic approaches that enable severely disabled individuals to communicate, operate devices and regain their mobility and independence.

An overview of the advances that have taken place in this field over the past 40 years is provided in the invited contribution that appears elsewhere in this issue (Cooper and Cooper). The papers selected for inclusion in this virtual supplement focus on those articles that have appeared in Medical Engineering & Physics, in the areas of assistive technologies, prosthetics & orthotics, rehabilitation robotics and mobility devices, specifically.

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Further reading

Abdulhasan ZM, Buckley JG. Gait termination on declined compared to level surface; contribution of terminating and trailing limb work in arresting centre of mass velocity. Med Eng Phys 2019;66:75–83.
Abu Osman NA, et al. The patellar tendon bar! Is it a necessary feature? Med Eng Phys 2010;32(7):760–5.
Affatato S, et al. 'Tribology and total hip joint replacement: current concepts in mechanical simulation. Med Eng Phys 2008;30(10):1305–17.
Ahmed TAE, Hincke MT. Mesenchymal stem cell – based tissue engineering strategies for repair of articular cartilage. Histol Histopathol 2014;29(6):669–89.
Aissaoui R, et al. Analysis of pressure distribution at the body-seat interface in able–bodied and paraplegic subjects using a deformable active contour algorithm. Med Eng Phys 2001;23(6):359–67.
Almeida DF, et al. Fully automatic segmentation of femurs with medullary canal definition in high and in low resolution CT scans. Med Eng Phys 2016;38(12):1474–80.
Arsene CTC, Gabrys B. Probabilistic finite element predictions of the human lower limb model in total knee replacement. Med Eng Phys 2013;35(8):1116–32.
Boutwell E, Stine R, Gard S. A novel in vivo impact device for evaluation of sudden limb loading response. Med Eng Phys 2015;37(1):151–5.
Braz GP, et al. A novel motion sensor-driven control system for FES-assisted walking after spinal cord injury: a pilot study. Med Eng Phys 2016;38(11):1223–31.
Brusco N, et al. Metrological validation for 3D modeling of dental plaster casts. Med Eng Phys 2007;29(9):954–66.
Chen DW, et al. Biomechanical consideration of total hip arthroplasty following failed fixation of femoral intertrochanteric fractures – a finite element analysis. Med Eng Phys 2013;35(5):569–75.
Chen M, et al. A self-adaptive foot-drop corrector using functional electrical stimulation (FES) modulated by tibialis anterior electromyography (EMG) dataset. Med Eng Phys 2013;35(2):195–204.
Chen SH, et al. Biomechanical comparison between lumbar disc arthroplasty and fusion. Med Eng Phys 2009;31(2):244–53.
Chen ZX, et al. Evaluation of a subject-specific musculoskeletal modelling framework for load prediction in total knee arthroplasty. Med Eng Phys 2016;38(8):708–16.
Cristofolini L, et al. A novel transducer for the measurement of cement-prosthesis interface forces in cemented orthopaedic devices. Med Eng Phys 2000;22(7):493–501.
Curtze C, et al. Staying in dynamic balance on a prosthetic limb: a leg to stand on? Med Eng Phys 2016;38(6):576–80.
Dickinson AS, Steer JW, Worsley PR. Finite element analysis of the amputated lower limb: a systematic review and recommendations. Med Eng Phys 2017;43:1–18.
Douglas TS, et al. Automatic segmentation of magnetic resonance images of the trans-femoral residual limb. Med Eng Phys 1998;20(10):756–63.
Draper ERC, et al. The design and performance of an experimental external fixator with variable axial stiffness and a compressive force transducer. Med Eng Phys 1997;19(8):690–5.
Draper ERC, et al. The design and performance of an experimental external fixation device with load transducers. Med Eng Phys 1995;17(8):618–24.
Falkenberg A, et al. Determination of local micromotion at the stem-neck taper junction of a bi-modular total hip prosthesis design. Med Eng Phys 2019;65:31–8.
Fisekovic N, Popovic DB. New controller for functional electrical stimulation systems. Med Eng Phys 2001;23(6):391–9.
Fromme P, et al. The effect of bone growth onto massive prostheses collars in protecting the implant from fracture. Med Eng Phys 2017;41:19–25.
Galibarov PE, Prendergast PJ, Lennon AB. A method to reconstruct patient-specific proximal femur surface models from planar pre-operative radiographs. Med Eng Phys 2010;32(10):1180–8.
Gislason MK, et al. 'Mechanical testing and modelling of the universal 2 implant'. Med Eng Phys 2016;38(6):511–17.
Gouwanda D, Gopalai AA. A robust real-time gait event detection using wireless gyroscope and its application on normal and altered gaits. Med Eng Phys 2015;37(2):219–25.
Grassi L, et al. Comprehensive evaluation of PCA-based finite element modelling of the human femur. Med Eng Phys 2014;36(10):1246–52.
Greene PJ, Granat MH. A knee and ankle flexing hybrid orthosis for paraplegic ambulation. Med Eng Phys 2003;25(7):539–45.
Helgason B, et al. 'Risk of failure during gait for direct skeletal attachment of a femoral prosthesis: a finite element study'. Med Eng Phys 2009;31(5):595–600.
Iaquinto JM, et al. 'Marker-based validation of a biplane fluoroscopy system for quantifying foot kinematics'. Med Eng Phys 2014;36(3):391–6.
Jimenez-Fabian R, Verlinden O. 'Review of control algorithms for robotic ankle systems in lower-limb orthoses, prostheses, and exoskeletons'. Med Eng Phys 2012;34(4):397–408.

https://doi.org/10.1016/j.medengphy.2019.09.006

Kaneko TS, Skinner HB, Keyak JH. 'Feasibility of a percutaneous technique for repairing proximal femora with simulated metastatic lesions'. Med Eng Phys 2007;29(5):594–601.
Karimi MT, et al. 'Evaluation of the magnitude of hip joint deformation in subjects with avascular necrosis of the hip joint during walking with and without Scottish Rite orthosis. Med Eng Phys 2017;40:110–16.
Kenney LPJ, et al. Dimensional change in muscle as a control signal for powered upper limb prostheses: a pilot study'. Med Eng Phys 1999;21(8):589–97.
Keyak JH. Improved prediction of proximal femoral fracture load using nonlinear finite element models. Med Eng Phys 2001;23(3):165–73.
Kobayashi T, et al. An articulated ankle-foot orthosis with adjustable plantarflexion resistance, dorsiflexion resistance and alignment: a pilot study on mechanical properties and effects on stroke hemiparetic gait. Med Eng Phys 2017;44:94–101.
Laszczak P, et al. Development and validation of a 3D-printed interfacial stress sensor for prosthetic applications. Med Eng Phys 2015;37(1):132–7.
Lattanzi R, et al. Specialised CT scan protocols for 3-D pre-operative planning of total hip replacement. Med Eng Phys 2004;26(3):237–45.
Light CM, Chappell PH. Development of a lightweight and adaptable multiple-axis hand prosthesis. Med Eng Phys 2000;22(10):679–84.
MacNeil JA, Boyd SK. Accuracy of high-resolution peripheral quantitative computed tomography for measurement of bone quality. Med Eng Phys 2007;29(10):1096–105.
Martelli S, et al. A new hip epiphyseal prosthesis: design revision driven by a validated numerical procedure. Med Eng Phys 2011;33(10):1203–11.
Martelli S, et al. Biomechanical robustness of a new proximal epiphyseal hip replacement to patient variability and surgical uncertainties: a Fe study. Med Eng Phys 2012;34(2):161–71.
Mathur N, Glesk I, Buis A. Comparison of adaptive neuro-fuzzy inference system (ANFIS) and Gaussian processes for machine learning (GPML) algorithms for the prediction of skin temperature in lower limb prostheses. Med Eng Phys 2016;38(10):1083–9.
McRae CGA, et al. Cycling for children with neuromuscular impairments using electrical stimulation-Development of tricycle-based systems. Med Eng Phys 2009;31(6):650–9.
Montagna L, et al. Investigation into the detection of marker movement by biplanar RSA. Med Eng Phys 2005;27(8):641–8.
Morasiewicz P, et al. Three-dimensional printing as a technology supporting the treatment of lower limb deformity and shortening with the Ilizarov method. Med Eng Phys 2018;57:69–74.
Nataraj R, Audu ML, Triolo RJ. Restoring standing capabilities with feedback control of functional neuromuscular stimulation following spinal cord injury. Med Eng Phys 2017;42:13–25.
O'Connor TJ, et al. Does computer game play aid in motivation of exercise and increase metabolic activity during wheelchair ergometry? Med Eng Phys 2001;23(4):267–73.
Omasta M, et al. Finite element analysis for the evaluation of the structural behaviour, of a prosthesis for trans-tibial amputees. Med Eng Phys 2012;34(1):38–45.
Paul JP. Three-dimensional finite element stress analysis of the polypropylene ankle–foot orthoses: static analysis. Med Eng Phys 1996;18(7):607.
Paul JP. Comparison of computational analysis with clinical measurement of stresses on a below-knee residual limb in a prosthetic socket Medical Engineering & Physics 22 (2000):607–12. Med Eng Phys 2001;23(7):519.
Paul JP. Optimizing the biomechanical compatibility of orthopedic screws for bone fracture fixation. Med Eng Phys 2003;25(5):435.
Pew C, Klute GK. Second generation prototype of a variable stiffness transverse plane adapter for a lower limb prosthesis. Med Eng Phys 2017;49:22–7.
Pinto JM, et al. Sensitivity analysis of geometric errors in additive manufacturing medical models. Med Eng Phys 2015;37(3):328–34.
Popovic D, et al. Automatic vs hand-controlled walking of paraplegics. Med Eng Phys 2003;25(1):63–73 .
Popovic MB. Control of neural prostheses for grasping and reaching. Med Eng Phys 2003;25(1):41–50.
Posatskiy AO, Chau T. 'Design and evaluation of a novel microphone-based mechanomyography sensor with cylindrical and conical acoustic chambers'. Med Eng Phys 2012;34(8):1184–90.
Provatidis C, et al. A finite element analysis of a T12 vertebra in two consecutive examinations to evaluate the progress of osteoporosis. Med Eng Phys 2009;31(6):632–41.
Rathnayaka K, et al. 'Correction of step artefact associated with MRI scanning of long bones'. Med Eng Phys 2013;35(7):988–93.
Rigney SM, Simmons A, Kark L. Mechanical characterization and comparison of energy storage and return prostheses. Med Eng Phys 2017;41:90–6.
Rushton DN. Functional electrical stimulation and rehabilitation – an hypothesis. Med Eng Phys 2003;25(1):75–8.
Rutherford M, et al. Operative and radiographic acetabular component orientation in total hip replacement: influence of pelvic orientation and surgical positioning technique. Med Eng Phys 2019;64:7–14.
Sanders JE, et al. Effects of socket size on metrics of socket fit in trans-tibial prosthesis users. Med Eng Phys 2017;44:32–43.
Santolaria J, et al. Error compensation method for improving the accuracy of biomodels obtained from CBCT data. Med Eng Phys 2014;36(3):397–404.
Shahar R, Banks-Sills L, Eliasy R. Stress and strain distribution in the intact canine femur: finite element analysis. Med Eng Phys 2003;25(5):387–95.
Stasiunas A, et al. Physiologically inspired signal preprocessing for auditory prostheses: insights from the electro-motility of the OHC. Med Eng Phys 2008;30(2):171–81.
Swanson EC, et al. Instrumented socket inserts for sensing interaction at the limb–socket interface. Med Eng Phys 2018;51:111–18.
Tang JH, et al. A combined kinematic and kinetic analysis at the residuum/socket interface of a knee-disarticulation amputee. Med Eng Phys 2017;49:131–9.
Tang JH, et al. Characterisation of dynamic couplings at lower limb residuum/socket interface using 3D motion capture. Med Eng Phys 2015;37(12):1162–8.
Thies SB, et al. Skill assessment in upper limb myoelectric prosthesis users: validation of a clinically feasible method for characterising upper limb temporal and amplitude variability during the performance of functional tasks. Med Eng Phys 2017;47:137–43.
Tong KY, et al. Effects of consecutive slips in nerve signals recorded by implanted cuff electrode. Med Eng Phys 2008;30(4):460–5.
van der Woude LHV, et al. Biomechanics and physiology in active manual wheelchair propulsion. Med Eng Phys 2001;23(10):713–33.
Viceconti M, et al. 'utomatic fracture reduction with a computer-controlled external fixator. Med Eng Phys 1994;16(2):143–9.
Vidaurre C, et al. EEG-based BCI for the linear control of an upper-limb neuroprosthesis. Med Eng Phys 2016;38(11):1195–204.
Wang XH, et al. A preclinical method for evaluating the kinematics of knee prostheses. Med Eng Phys 2019;66:84–90.
Weinert-Aplin RA, et al. Energy flow analysis of amputee walking shows a proximally-directed transfer of energy in intact limbs, compared to a distally-directed transfer in prosthetic limbs at push-off. Med Eng Phys 2017;39:73–82.
Wu YY, Plakseychuk A, Shimada K. Computer-aided surgical planner for a new bone deformity correction device using axis-angle representation. Med Eng Phys 2014;36(11):1536–42.
Zannoni C, et al. Analysis of titanium induced ct artifacts in the development of biomechanical finite element models. Med Eng Phys 1998;20(9):653–9.
Zhang M, Mak AFT, Roberts VC. Finite element modelling of a residual lower-limb in a prosthetic socket: a survey of the development in the first decade. Med Eng Phys 1998;20(5):360–73.
Zhang M, Roberts C. Comparison of computational analysis with clinical measurement of stresses on below-knee residual limb in a prosthetic socket. Med Eng Phys 2000;22(9):607–12.
Zhang M, et al. Frictional action at lower limb prosthetic socket interface. Med Eng Phys 1996;18(3):207–14.