National and Institutional Policies of Rehabilitation

Indonesian Government all Indonesian Citizens and Residences as a mandate of the Indonesian Constitution 1945. The protection includes the development of welfare and health which includes physical and mental health, including persons with disabilities (PWD). In particular, the State's attention to Disabilities is manifested in Act Law No. 8 of 2016 (Undang-Undang No.8 Tahun 2016), which is a reference for government policy in providing protection for people with disabilities. As stated in Article 66-68, national and local governments have obligation to provide and organize medical rehabilitation according to the varieties of the disability. Scopes, Aims, and functions of the habilitation and rehabilitation are described in Article 110-113.

Institut Teknologi Sepuluh Nopember (ITS) has been established a National University in 1960 in order to carry out the function of higher education, especially in the field of technology (Decree RI No. 101250/U.U.). Biomedical Engineering Education has been included in Curriculum of Department of Electrical Engineering since 1984. Establishment of Biomedical Engineering (BME) Department (Decree Ministry of Higher Education No. 102/M/Kp/III/2015)in 2015 has strengthen ITS efforts in developments of engineering, and technology for medicine.

ITS focuses on Rehabilitation as one of the leading fields in biomedical engineering as an excellence program. This is manifested in the form of establishment of Rehabilitation Engineering Major in BME Department ITS, whit support of other Majors including Biomedical Instrumentation, Biomedical Imaging and Image Processing, and Medical Informatics (Curriculum Program, BME Dept ITS 2015-present).

Human resource developments with rehabilitation engineering expertise are supported by the development of an appropriate curriculum and global collaboration. Lecturers and researchers developed their expertise in the field of rehabilitation engineering as ITS policy and supported by global collaboration program (Monbusho Scholarship, ITS-Tohoku Collaboration Program, DSP Tohoku Univ., Miyagi Prefectural Government under the Sendai Advanced Preventive Health Care Services Cluster). Research and Development in Biomedical Engineering Department has been carried out at ITS and in collaboration with Tohoku University of Japan which is leading in the field of Motor Rehabilitation. Followings are developed system and publications related to Rehabilitation Engineering reflects the policy of ITS supporting Technology for Rehabilitation of Person with Disabilities.

Systems:

1. Wearable Functional Electrical Stimulation (FES) System for lower limb
2. Wearable Functional Electrical Stimulation (FES) System for upper limb
3. Exoskeleton for upper limb restoration
4. Wearable Human Gait Measurement System
5. Software of Gait Analysis
6. Electric Wheelchair with Joystick
7. Electric Wheelchair with EMG input
8. Electric Wheelchair with EMG bioimpedance input

Publications:

1. Design of Parameter Estimation Method of Fuzzy FES Controller: Computer Simulation Test in Wrist Joint Control (Fauzan Arrofiqi, Takashi Watanabe, Achmad Arifin, Conference: 2022 IEEE 4th Global Conference on Life Sciences and Technologies (LifeTech))
2. Upper Limb Function Restoration using Arm Cycling Functional Electrical Stimulation with Fuzzy Logic Controller (Widya Dwi Ariyanti, Achmad Arifin, Siti Halimah Baki, M Hilman Fatoni, Conference: 2021 4th International Conference on Bio-Engineering for Smart Technologies (BioSMART))
3. Instrumentation Design of Game Rehabilitation with Myoelectric Command (Ni Wayan Yuliani, Achmad Arifin, M. Hilman Fatoni, Josaphat Pramudijanto, 2021 4th International Conference on Bio-Engineering for Smart Technologies (BioSMART))
4. Design of Elbow Exoskeleton with Wireless System Control for Post Stroke Flexion-Extension Rehabilitation (Laily Asna Safira, Achmad Arifin, Atar Fuady Babgei, Eko Agus Suprayitno, 2021 4th International Conference on Bio-Engineering for Smart Technologies (BioSMART))
5. A Computer Simulation Test for Validation of Linear Model Predictive Control with Nonlinear Transformation for FES in Wrist Joint Control (Fauzan Arrofiqi, Takashi Watanabe, Achmad Arifin, Conference: 2021 6th International Conference on Intelligent Informatics and Biomedical Sciences (ICIIBMS))
6. Multi-input Multi-output Fuzzy Logic Controller for Hybrid Exoskeleton and Functional Electrical Stimulation for Hand Movements Rehabilitation of Hemiparesis Patients (Danar Agnanto, Achmad Arifin, Atar Fuady Babgei, 2021 International Seminar on Intelligent Technology and Its Applications (ISITIA))
7. Robotic Hand Exoskeleton With Tactile Force Feedback For Post-Stroke Spasticity Rehabilitation (Hanan Yumna, Achmad Arifin, Atar Fuady Babgei, 2021 International Seminar on Intelligent Technology and Its Applications (ISITIA))
8. Control of Wheelchair on the Ramp Trajectory Using Bioelectric Impedance with Fuzzy-PID Controller (Masyitah Aulia, Achmad Arifin, Djoko Purwanto, 1st International Conference on Electronics, Biomedical Engineering, and Health Informatics)
9. n Analysis on the Feasibility of a Low-cost Fall Detection System: Feasibility study on threshold-based fall detection system that is realized using ADXL 345 tri-axial accelerometer which is considered as a low-cost sensor (Samuel Carya Budi, Achmad Arifin, Atar Fuady Babgei, 2020 4th International Conference on Computational Biology and Bioinformatics)
10. Design and Implementation of Wrist Joint Movements Restoration System Using Wearable Functional Electrical Stimulation with a Fuzzy-PID Controller (Dyah Ayu Rachmawati, Achmad Arifin, Kevin Leonardo, Fauzan Arrofiqi, M Hilman Fatoni, Takashi Watanabe, 2020 4th International Conference on Computational Biology and Bioinformatics)
11. Design of Fuzzy Logic Control in Functional Electrical Stimulation (FES) Cycling Exercise for Stroke Patients (Rizky Mardyah, Achmad Arifin, Andra Risciawan, Siti Halimah Baki, Rudy Dikairono, 2020 International Conference on Computer Engineering, Network, and Intelligent Multimedia (CENIM))
12. Subject Intention Speed Control Of Electric Wheelchair For Person With Disabilities Using Myoelectric Signals (Elvina Ambarwati, Achmad Arifin, M Hilman Fatoni, I Wayan Nudra Barjantika Pradivta, Tri Arief Sardjono, Andra Risciawan, 2020

International Conference on Computer Engineering, Network, and Intelligent Multimedia (CENIM))

13. Design of Myoelectric Control Command of Electric Wheelchair as Personal Mobility for Disabled Person (I Wayan Nudra Barjantika Pradivta, Achmad Arifin, Fauzan Arrofiqi, Takashi Watanabe, 2019 International Biomedical Instrumentation and Technology Conference)
14. Design and tests of a wearable functional electrical stimulation (FES) system for knee joint movement using cycle-to-cycle control method (Aidatunisadina Linazizah Basith, Stanley Setiawan, Achmad Arifin, Fauzan Arrofiqi, Mohammad Nuh, Journal of Theoretical and Applied Information Technology 95(11):2523-2531)
15. Embedded fuzzy logic controller for functional electrical stimulation system (Aidatunisadina Linazizah Basith , Stanley Setiawan, Achmad Arifin, Fauzan Arrofiqi, Takashi Watanabe, Mohammad Nuh, 2016 International Seminar on Intelligent Technology and Its Applications)
16. Design of Wearable System for Closed-Loop Control of Gait Restoration System by Functional Electrical Stimulation (Fauzan Arrofiqi, Achmad Arifin, Benicditus Indrajaya, 2016 International Seminar on Intelligent Technology and Its Applications)
17. An Intelligent System Approach for Solving Rehabilitation Engineering Problems : From Gait Analysis to FES Control through Computation Biomechanics (Achmad Arifin, Invited Lecture SITIA 2010)
18. Ankle and Knee Joint Angle Measurements during Gait with Wearable Sensor System for Rehabilitation (Hiroki
    Saito, Takashi Watanabe, Achmad Arifin, 2010 World Congress on Medical Physics and Biomedical Engineering)
19. *Preliminary Tests of a Practical Fuzzy FES Controller Based on Cycle-to-Cycle Control in the Knee Flexion and Extension Control (*WATANABE, Takashi; MASUKO, Tomoya; ARIFIN, Achmad, IEICE TRANSACTIONS on Information and Systems, Vol. E92-D, No. 7, pp. 1507-1510, The Institute of Electronics, Information and Communication Engineers, 2009*)*
20. Application of Knowledge Engineering and Fuzzy System in Realizing Cycle-to-Cycle Control Method for Swing Phase of FES-induced Gait (Achmad Arifin, Takashi Watanabe, Tomoya Masuko, Invited Lecture on Neural Engineering Session, Proc. 3rd Intl. Symp. Medical, Bio-Nano Electronics, pp. 43-51)
21. *Feasibility Study of Fuzzy FES Controller Based on Cycle-to-Cycle Control: An Experimental Test of Knee Extension Control (*WATANABE, Takashi; MASUKO, Tomoya; ARIFIN, Achmad; YOSHIZAWA, Makoto, IEICE TRANSACTIONS on Information and Systems, Vol. E91-D, No. 3, pp. 865-868, The Institute of Electronics, Information and Communication Engineers, 2008*)*
22. An Error Reduction Method of Portable, Low-Cost Joint Angle Sensor System for Human Movement Measurement and Control (Achmad Arifin, Hiroki Saito, Takashi Watanabe, IEICE Technical Report on MBE Volume: MBE2008-69, pp.31-34)
23. *A test of fuzzy controller of cycle-to-cycle control for controlling three-joint movements of swing phase of FES gait (*Arifin, Achmad; Watanabe, Takashi; Yoshizawa, Makoto, バイオメカニズム学術講演会予稿集, Vol. 25, pp. 43-46, バイオメカニズム学会, 2006)
24. *Design of Fuzzy Logic Controller of the Cycle to Cycle Control for Swing Phase of Hemiplegic Gait Induced by FES (*Arifin, A.; Watanabe, T.; Hoshimiya, N, IEICE Trans. Inf. & Syst., Vol. E89-D, No. 4, pp. 1525-1533, The Institute of Electronics, Information and Communication Engineers, 2006*)*

25. Knowledge Engineering Approach in Developing Framework of the Cycle-to-Cycle Control for Swing Phase of Hemiplegic Gait Induced by FES (Achmad Arifin, Takashi Watanabe, The 13th Japan FES Association Conference, pp. 44-47)
26. *Computer Simulation Test of Fuzzy Controller for the Cycle-to-Cycle Control of Knee Joint Movements of Swing Phase of FES Gait (*Arifin, Achmad; WATANABE, Takashi; Hoshimiya, Nozomu;, IEICE TRANSACTIONS on Information and Systems, Vol. E88-D, No. 7, pp. 1763-1766, The Institute of Electronics, Information and Communication Engineers, 2005)
27. *Cycle-to-Cycle Control of Swing Phase of FES-induced Hemiplegic Gait : A Computer Simulation with Different Controllers (*ARIFIN, Achmad; WATANABE, Takashi; HOSHIMIYA, Nozomu, IEICE technical report. ME and bio cybernetics, Vol. 102, No. 481, pp. 1-4, The Institute of Electronics, Information and Communication Engineers, 2002)