CHI CONG NGUYEN

Level 1, E26 Biological Sciences South,

Graduate School of Biomedical Engineering, UNSW Sydney.

(+61) 434709868 cong.c.nuyen@unsw.edu.au profile/Chi-Nguyen-268

EDUCATION & ACHIEVEMENTS

- **Hanoi University of Science and Technology (HUST) – Hanoi, Vietnam** *2014-2019*
  Mechatronics Engineering
  GPA: **3.64/4.**
  Final thesis: Climbing and cleaning silo's wall robot using vacuum principle and wireless control technology.
- **Shibaura Institute of Technology (SIT) – Saitama, Japan** *Aug 2018 - Feb 2019*
  Engineering and Science
  Favorite fields of study: Mechanical - Control Engineering, Robotics.
- **University of New South Wales, Sydney, Australia** *from Sep 2021*
  Biomedical Engieening – Ph.D. Student
  Thesis: ***Extend the Reach of Teleoperated Flexible Surgical Robotic System for Cardiac and Gastrointestinal Disorders****.*

HONOURS/AWARDS

- ***The Vingroup Science and Technology Scholarship Program for Overseas Study for Master's and Doctoral Degrees. (https://scholarships.vinuni.edu.vn/cohort-2021/)***
- HUST**Valedictorian Award**.
- HUST Exellence Scholarship for the outstanding performance.
- **Lawrence S.Ting** scholarship.
- Student research competition **Award**.
- **Global Project-Based Learning** (GPBL) program in Hust certificate.
- SIT exchange scholarship.
- SIT Certificate of Matriculation.
- Presented **Packaging-Robot idea at GPBL competition conference** judged by the 5 biggest local companies **in Saitama, Japan**.
- **Global Project-Based Learning program** in SIT certificate.

RESEARCH & WORK EXPERIENCE

- **UNSW Medical Robotic Lab,** *from Sep 2021*
  Graduate School of Biomedical Engineering
  Ph.D. Student
  - Project 1: **Human-Machine Interaction and Emerging Technologies for Advanced User Interfaces in Teleoperated Surgical Robotic Systems:**

This was my very first project working under the delicate supervision of **Dr. Thanh Nho Do** and **Prof. Nigel Lovell**. In this project, **I studied the user interfaces** of emerging **teleoperated surgical robotic systems (TSRSs)** to get a broad overview of the surgical robot market, and I also looked at the advantages and disadvantages of the most recent developments in terms of how people interact with machines. **I also investigated** the potential of **advanced sensing, haptic, smart garments, and medical image artificial intelligence (AI) assistance technologies for use in master consoles of TSRSs**. This project allowed me to collaborate with Dr. Shing Wong, the head of the Colorectal Unit at Prince of Wales Hospital, who gave me a lot of advice and shared the current clinical challenges and needs..

- Project 2: **Hydraulic Soft Robotic Device with Bidirectional Bending End-Effector for Minimally Invasive Surgery (MIS):**

  This project marked my first time working with physical materials and facilities in the UNSW Medical Robotic Lab with my team members, where **I designed, modelized and fabricated a minature soft catheter**, which can be used for **cardiac and gastrointestinal ablation**. This miniature catheter can **bend bidirectionally** and be controlled simply by a designated handheld controller. One of the significant capabilities of this catheter is that it can **bend over 360º forming a spiral shape**, this feature can be useful for **blood clots removal** replacing the current stent devices.

- Project 3: **Novel Cardiac Ablation Catheter with Variable Stiffness Stabilizing Mechanism and Contact Force Sensing:**

  In this project, **I designed, modelized, fabricated and characterized a novel soft robotic catheter** which can be used for **ablation procudures in the heart's Right Atrium**. This new catheter featured **an omnidirectional manipulator** for navigation and bending motion. It also included **a special stabilizing mechanism with variable stiffness capabilities**, which helps it mechanically stable in the inferior vena cava (IVC), and **a novel soft force sensor** for monitoring tool-tissue contact. This new catheter device had a sufficient number of fundamental functions that addressed the current issues in robotic catheter systems such as limited workspace and flexibility, instability, and a lack of force feedback.

- Project 4: **Soft Robotic Gripper for (Unmanned underwater vehicle) UUV Collaborated with a Defense Company:**

  This is a unique project because its goal is **to apply our technologies to real-world problems**, specifically using soft robots to **grip heavy objects**, in this case a **UUV**. My role in this project is to **design and build a large gripper inspired by manta rays**. As a result, this gripper has two large wings, each with four novel positive suction cups attached. This device is capable of **gripping a larger cylinder object with a diameter of more than 160 mm and a weight of more than 10 kilogrammes.**

- Project 5: **Wearable User Interface with Haptics Using Novel Soft Syringe Architecture:**

As part of my main thesis, I am currently developing **a wearable master console to control my robotic catheters** and completing **a new teleoperated robotic surgical system**. The most notable innovation of this user interface is that it uses **a new soft syringe architecture** (**SSA**) instead of any DC motors to actuate the robotic catheter's manipulator. Technically speaking, the SSA's operating principle is based on **the linear relationship between two muscles**; when the master muscle is stretched, the slave muscle is mechanically actuated, causing the catheter manipulator to move. This idea allows for **the rendering of the haptic feedback force** in the opposite direction. The ultimate goal of this project is to **give the surgeon more ergonomics and comforts** than the currently available complex surgical systems**,** in addition to **a straightforward system improving human-machine interaction**.

❖ **Viettel High Technology Industries Corporation – Viettel Group, Vietnam.** *Jun 2019 – Jul 2021*

Mechanical Engineer

- Responded to multiple tasks including researching, designing, and developing Viettel's products (Radio Remote Unit - RRU) in the **5G project**.
- Analyzed and optimize Heatsink models, research and apply new methods to cool operating chips on RRU (5G product).
- Took responses to liaise with providing and fabricating partners to order products and supervise the progress.

❖ **Mechatronics Laboratory CIMLAB, Hanoi University of Science and Technology, Vietnam.** *Jan 2016 – May 2019*

Student Research

- Project 1: **Climbing and Cleaning Silo's Wall Robot Using Vacuum Principle and Wireless Control echnology:**

  This was my final thesis instructed by **Dr. Nguyen Ngoc Kien**. It was to create a wall climbing Robot to handle the stains on Silo's wall. One of the most difficult questions of this project was **"How to keep a 5-kilograms Robot stably moving of the wall?".** To solve this question, a high-speed RC brushless – Ducted fan Motor was used to generate a sufficiently large vacuum pressure. This force could be able to balance gravity and the torque of gravity, it means this motor could keep the Robot on the wall. DC motors are added, and the joints help the robot move on the wall. The whole system is controlled by signals from a Mobile Phone via the Bluetooth module of Arduino. This project was awarded **the Creative Idea Award in the HUST student research competition.**

- Project 2: **Self-Electric-Generating Exercise Machine:**

  Basically, this machine was designed based on the main mechanical foundation to generate electricity during human exercise. The machine was like a bicycle, equipped with a generator in the lower body and an energy storage tank, this energy was served for lighting and fans. This machine was presented in **the second round of the German Vietnamese Best Idea Award 2017.**

- Project 3: **Modeling, Control, and Simulation of a Scara RRP-type Robot:**

This project was my very first subject thesis under the supervision of **Prof. Tran Van Dich**, to model the Scara Revolute-Revolute-Prismatic-type Robot's movement from point to point in each trajectory pattern. Firstly, a 3D model of this Robot was designed with mechanical calculations. Secondly, to obtain forward and inverse kinematic equations of the Robot, D-H parameters and analytical methods were used. The robot trajectory was planned from those equations and the 3D model was transferred the model to the Matlab-Simulink environment and a control structure was designed from blocks in this environment. Finally, actuators were added into the joints and the entire movement of the robot was simulated.

RESEARCH PAPERS & PATENT (My Google scholar**:** https://bit.ly/3UD63L2)

Patent

1. *T.N. Do, M.T. Thai. P.T. Phan, N.H. Lovell, J. Davies,* ***C.C. Nguyen*** *"Advanced Soft Robotic System for Minimally Invasive Surgery and In Situ 3D Bioprinting". AU provisional Patent. (**Accepted**).*

International Journal Articles

1. ***C. C. Nguyen****, S. Wong, M. T. Thai, T. T. Hoang, P. T. Phan, J. Davies, N. H. Lovell, T. N. Do*, "Human-Machine Interaction and Emerging Technologies for Advanced User Interfaces in Teleoperated Surgical Robotic Systems". (**Submitted to Advanced Sensor Research**).*
2. ***C. C. Nguyen****, T. Teh, M. T. Thai, P. T. Phan, T. T. Hoang, J. Davies, H. P. Phan, C. H. Wang, N. H. Lovell, T. N. Do*, "A Handheld Hydraulic Soft Robotic Device with Bidirectional Bending End-Effector for Minimally Invasive Surgery ". (**Submitted to IEEE Transactions on Medical Robotics and Bionics**).*
3. ***C. C. Nguyen****, M. T. Thai, T. T. Hoang, J. Davies, P. T. Phan, H. P. Phan, N. H. Lovell, T. N. Do*, "A Novel Cardiac Ablation Catheter with Variable Stiffness Stabilizing Mechanism and Force Sensing". (**Submitted to Sensors and Actuators A: Physical**).*
4. *T. T. Hoang, L. Sy, M. Bussu, M. T. Thai, H. Low, P. T. Phan, J. Davies,* ***C. C. Nguyen****, N. H. Lovell, T. N. Do*, "A Wearable Soft Fabric Sleeve for Upper Limb Augmentation ", Sensors, 2021. (**Published**).*
5. *P. T. Phan, M. T. Thai, T. T. Hoang, J. Davies,* ***C. C. Nguyen****, N. H. Lovell, T. N. Do*, "Smart textiles using fluid-driven artificial muscle fibers ". Scientific reports, 2022. (**Published**).*
   - ***Featured on*** ***The Washington Post***, ***IEEE Spectrum***, ***Engineers Australia***, ***UNSW Newsroom***, ***Daily Mail***, ***the Spokeman-review***, ***Gizmodo***, ***Dailymotion***, ***Sunday Tribune*** *(printed paper)*, ***TechXplore***, ***The West Australia***, ***Yahoo!news***, ***the Manila Times***, ***TodayHeadline***, ***Xinhua***, ***China.org***, ***Newcastleherald***, ***the Islander***, ***medianet***, ***Medium***, ***NATIONTHAILAN***, ***STARTUPtoENTERPRISE***, ***WION***, ***tuoitre.vn***, ***saigongiaiphong***, ***alouc***, ***baomoi***, ***khoa hoc phat trien***, ***Independent Press***, *etc.*
   - ***Film & TV:*** ***Thomson Reuters*** ***(1)***, ***South China Morning Post*** ***(1)***, ***Future Now***, ***TVPWorld***, ***Journal Star***, ***Popular Mechanics***, ***ElkoDaily***, ***VTV1***, ***VTV3***, *THVL*, ***THDT***, ***Truyen Hinh Thong Tan***, ***Truyen Hinh Can Tho***, *etc.*

6. *T. T. Hoang, P. T. Phan, M. T. Thai, J. Davies,* ***C. C. Nguyen****, H. P. Phan, N. H. Lovell, T. N. Do*, "Magnetically Engineered Conductivity of Soft Liquid Metal Composites for Robotic, Wearable Electronic, and Medical Applications", Advanced Intelligent Systems, 2022. (****Published****).*
7. *M. T. Thai, P. T. Phan, T. T. Hoang, J. Davies,* ***C. C. Nguyen****, H.P. Phan, N. H. Lovell, T. N. Do*, "Advanced Soft Robotic System for In Situ 3D Bioprinting and Endoscopic Surgery". (****Submitted to Advanced Science****).*
8. *J. Davies, M. T. Thai, T. T. Hoang,* ***C. C. Nguyen****, P. T. Phan, H.P. Phan, N. H. Lovell, T. N. Do*, "A Stretchable Filament Sensor with Tunable Sensitivity for Wearable Robotics and Healthcare Applications". (****In Revision to Advanced Materials Technologies****).*
9. ***C. C. Nguyen****, M. D. Bui, N. K. Nguyen, V. T. Nguyen (2022). "Optimal Design of V-Shaped Fin Heat Sink for Active Antenna Unit of 5G Base Station". Journal of Engineering & Technological Sciences, 54(3). (****Published****).*
10. ***C.C. Nguyen****, Nguyen, V.T., Tao, N.L., Nguyen, T.T., Nguyen, N.K. and Bui, N.T., 2021, May. Design and Fabrication of Silo Cleaning Robot Using Vacuum Principle. In Journal of Physics: Conference Series (Vol. 1922, No. 1, p. 012009). IOP Publishing. (****Published****).*
11. *Nguyen, N. K.,* ***C. C. Nguyen****, & Bui, N. T. (2021). "A Study of Wall-Climbing Robot for Cleaning Silo Using Vacuum Principle". International Journal of Mechanical Engineering and Robotics Research. (****Published****).*

International conference papers

1. ***C. C. Nguyen,*** *T. Teh, M. T. Thai, P. T. Phan, T. T. Hoang, H. Low, J. Davies, E. Nicotra, N. H. Lovell, T. N. Do*, "Bidirectional Soft Robotic Catheter for Arrhythmia Treatment", IEEE International Conference on Robotics and Automation (ICRA), 2022. (****Published****). (****Ranked #1 in Robotics****)*

2. *J. Davies, P. T. Phan, D. Huang, T. T. Hoang, H. Low, M. T. Thai,* ***C. C. Nguyen****, E. Nicotra, N. H. Lovell, T. N. Do*, "Hydraulically Actuated Soft Tubular Gripper", International Conference on Robotics and Automation (ICRA), 2022.* ***(Published). (Ranked #1 in Robotics)***

3. ***C. C. Nguyen****, J. Davies, M. T. Thai, T. T. Hoang, P. T. Phan, H. P. Phan, N. H. Lovell, T. N. Do*, "A Handheld Hydraulic Cardiac Catheter with Omnidirectional Manipulator and Touch Sensing". (****Submitted to IEEE International Conference on Robotics and Automation (ICRA), 2023****). (****Ranked #1 in Robotics****)*

4. *J. Davies, M. T. Thai, T. T. Hoang,* ***C. C. Nguyen****, P. T. Phan, N. H. Lovell, T. N. Do, "A Flexible 3D Force Sensor with Tunable Sensitivity",(****Submitted to IEEE International Conference on Robotics and Automation (ICRA), 2023****). (****Ranked #1 in Robotics****).*

5. *V. T. Nguyen, C.* ***C. Nguyen*** *(2022). "Effect of Geometric Parameters of Heat Sink on Thermal Dissipation for Active Antenna Unit". In Regional Conference in Mechanical Manufacturing Engineering (pp. 343-351). Springer, Singapore. (****Published****).*

6. *M.D. Bui,* ***C. C. Nguyen****, "RRU 4G & 5G Heatsink Design and Experimental Evaluation". International Conference on Industrial Engineering and Operations Management Singapore, 2021. (****Published****).*

MEDIA

- My catheter devices were filmed by **Thomson Reuters** and featured on their channel as in this link: https://reut.rs/3Af2MJH ; https://www.youtube.com/watch?v=NvPl8ytEe3Q; https://www.youtube.com/watch?v=Bu0qdb0u8BI; https://tvpworld.com/61875504/scientists-develop-biological-musclelike-smart-textile https://journalstar.com/news/science/this-smart-fabric-can-contract-and-lift-weight-just-like-muscles/video_b77eb47b-9640-5c52-b8d8-0e730da6f9b2.html https://www.popularmechanics.co.za/science/watch-smart-textiles-replicate-the-movement-of-muscles/ https://elkodaily.com/news/science/this-smart-fabric-can-contract-and-lift-weight-just-like-muscles/video_6ef3b1b0-99d0-57bf-acf5-1b55a80f1d60.html https://vtv.vn/the-gioi/soi-thong-minh-co-the-co-gian-nhu-soi-co-cua-nguoi-20220818235920612.htm https://www.youtube.com/watch?v=h9dnaZdo7OI

SKILLS

- Possess extensive experience in **robotic designing**, **modeling**, **analyzing**, and **system identification.**
- Possess solid knowledge in **soft robotics**, **surgical robots**, and **haptics**.
- Expertise with **CAD** software (**Solidwork, Autocad**), simulation software (**Ansys, Matlab**), and office software (**MS Word, Excel, Powerpoint**).
- Have a solid grasp of **C, C ++ programming language**.

EXTRACURRICULAR ACTIVITIES

❖ **TiengAnhCong English Club** *Feb 2019 – Nov 2019*
Co-Founder: Established speaking English classes for **40 student participants.**

❖ **Career workshop at Ba Vi highschool** *Dec 2019*
Speaker: Shared experiences, and consulted for almost **1500 students**.

REFERENCES

❖ **Prof. NIGEL LOVELL**
Scientia Professor, Head of the Graduate School of Biomedical Engineering, Faculty of Engineering, UNSW, Sydney NSW 2052, AUSTRALIA.
Room 525, Samuels Building.
Email: n.lovell@unsw.edu.au
Phone: +61 29385 3922

❖ **Dr. THANH NHO DO**
Scientia Senior Lecturer, Graduate School of Biomedical Engineering, Faculty of Engineering, UNSW, Sydney NSW 2052, AUSTRALIA.
Room 1003, Level 1, E26 Biological Sciences South.
Email: tn.do@unsw.edu.au
Phone: +61 9385 2892