

附件四、技術說明表



無支撐材之積層製造實現方式

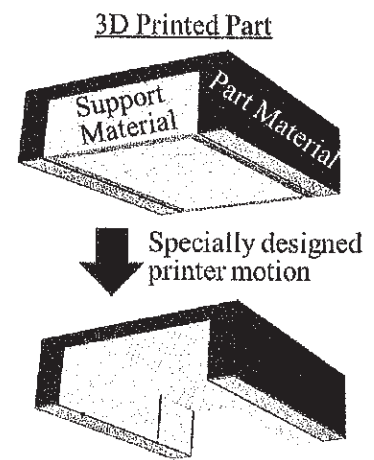
提案人：李典儒 助理教授

單位：國立臺灣大學 機械工程學系/研究所

簡歷：<https://sites.google.com/view/ntusamlab/home>

市場及需求：積層製造(Additive Manufacturing, AM)，又稱 3D 列印(3D Printing)，由於其可以達到高幾何複雜度的設計、高度客製化、低材料成本、加速生產製造離型反覆設計的開發階段等優點，自 1980 年代起，積層製造在全球市場的市佔率飛快地成長。積層製造於 2017 年的全球總收入約為 85 億美元，預估將在 2023 年達到總收入 318 億，擁有 24.6% 相當高的市場成長率。在積層製造方法中，材料擠出成型

(Material Extrusion, MEX) 為業界及學界最廣泛使用的 AM 技術，然而 MEX 由於製程的特性，需要額外的支撐材料來幫助物體成形，此支撐材料不僅會增加列印時間，增加材料使用成本，甚至會需要額外的後處理來達到最後幾何要求，因而增加人力成本。上述現象導致 MEX 仍無法大量運用在產品量產階段，也侷限了其製程永續性。



技術摘要(含成果)：此專利技術提出創新的 MEX 列印平台模組與噴頭抬升機構，可加裝於任意 MEX 機台上(不需更改原本機台機構)，也可根據欲列印之物體大小調整平台模組的大小，再利用噴頭抬升機構與平台模組之間的配合動作，使物體在列印過程中不用完全依賴支撐材料也可成型，進而大幅降低材料用量(最多可減少 87% 的材料用量)以及縮短列印時間(最多可減 77% 的列印時間)，提升 MEX 的生產效能並減少生產成本。

優勢：減少材料用量、減少製程後處理的需求(減少人力成本)、減少列印所需時間、可用性高(可應用在任意 MEX 機台上)、提升 MEX 生產效能與製程永續性。

競爭產品：目前積層製造方法唯一不需要支撐材料的方法是粉末熔融燒結技術，其製程價格昂貴且使用材料種類受限。而市面上沒有任何 MEX 機台可以減少支撐材料的使用，大多還是仰賴人工在製程結束後手動移除支撐材料。

專利現況：本研究團隊在此技術上已經具有將近 2 年研究投入，並且已成功建構出離型品，也已證明其在產能提升上的表現(包含材料與製程時間的減少等)

聯絡方式：臺大產學合作總中心 Tel: 02-3366-9945, E-mail: ordiac@ntu.edu.tw

本資料僅供國立臺灣大學專利/技術申請使用，嚴禁使用全部或部分內容於其他用途。若有疑問請與我們聯繫，我們將盡力協助您。



Method of Support-Free Additive Manufacturing

PI : Prof. Dian-Ru Li

Department of Mechanical Engineering, National Taiwan U.

Experience: <https://sites.google.com/view/ntusamlab/home>

Market Needs: Additive Manufacturing (AM), also called 3D printing, has gain more and more attentions in the field of manufacturing due to its capabilities of high design freedom, customization and fast design iterations. The AM market has rapidly expanded and achieved 30 billion revenues worldwide in 2023. Among different AM methods, material extrusion (MEX) is the most commonly used. However, MEX requires additional support materials to provide structural support during material deposition of the main part, which significantly increases the printing time and the material cost. Furthermore, additional post-processing procedures are usually required to remove the support materials, thus increasing the labor costs. Above facts limit the use of MEX in production applications and the process sustainability.

Our Technology: We have developed a novel MEX printing platform module and a extruder lifting mechanism, which can be attached onto any MEX machines without any machine modifications. The size of the platform module can also be adjusted based on the printing object size. By utilizing the designed motions of the extruder lifting mechanism and the platform module, the part can be formed in MEX with the minimized use of the support materials, reducing the total material use (up to 87% reduction) and the total printing time (up to 77% reduction). This can also improve the MEX process efficiency and production capability.

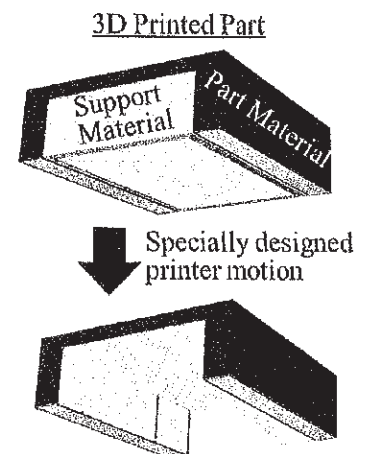
Strength: Reduction of the total material use, reduction of the need of post-processing and the associated labor costs, reduction of the printing time, enhanced MEX process efficiency and productability, high usability (can be applied on any MEX machines), improved process sustainability.

Competing Products: The only AM method which does not require support materials is laser powder sintering, which is an expensive process with limited material selection. There is no commercial MEX machine capable of reducing support materials, and thus manual support material removal processes are still required with high labor costs.

Intellectual Properties: We have conducted the research on this invention for 2 years and successfully built the prototype with proved capabilities on time and material reduction.

Contact (do not need to fill out): Center for Industry-Academia Collaboration, NTU.

Tel: 02-3366-9945, E-mail: ordiac@ntu.edu.tw



This information herein is intended for potential license of NTU technology only. Other usage of all or portion of this information in whatever form or means is strictly prohibited. Kindly contact us and we will help to achieve your goal the best we can.