



**From:** Pino Trogu trogu@sfsu.edu  
**Subject:** Re: sabbatical proposal  
**Date:** October 2, 2023 at 9:37 AM  
**To:** Prof. Jian S. Dai jian.dai@kcl.ac.uk  
**Bcc:** Pino Trogu trogu@sfsu.edu

Dear Prof. Dai,

Thank you so much for your quick response!

I will then list King's College and Prof. Luo as the primary site for my visiting scholar position, and add you, Prof. Feng, and Southern University of Science and Technology as the additional collaborative site during the academic year 2024-2025.

Once again, I truly appreciate your support and very much look forward to our collaboration.

All the best,

Pino

On Oct 2, 2023, at 12:18 AM, Jian Dai <jian.dai@kcl.ac.uk> wrote:

Dear Pino,

That is great. Since I take the emeritus position at King's and move to Southern University of Science and Technology, I could ask my close colleague Prof Shan Luo (Reader in Robotics) to take your visit and I could arrange your visit at Southern University of Science and Technology.

With best wishes

Jian

Professor Jian S Dai,  
Fellow of the Royal Academy of Engineering  
Member of Academia Europaea  
FREng, MAE, FIEEE, FASME, FRSA, FIMechE

Editor-in-Chief of Robotica (Est. 1983)

-----Original Message-----

From: Pino Trogu <trogu@sfsu.edu>  
Date: Sunday, 1 October 2023 at 10:20  
To: Jian Dai <jian.dai@kcl.ac.uk>  
Subject: sabbatical proposal

Hello Prof. Dai

If you have no objection, I was gonna list you as a possible collaborator in my sabbatical proposal, together with Prof. Feng, and Prof. Herder from Delft. As of now I am not actually mentioning travelling to London or Delft, only a general collaboration. I attach the draft of the proposal. I hope it's OK but let me know if otherwise or if you have any thoughts about my earlier email. I have to submit the draft tomorrow Monday Oct. 2.

Thanks again!

Pino

> On Sep 19, 2023, at 11:55 PM, Pino Trogu <[trogu@sfsu.edu](mailto:trogu@sfsu.edu)> wrote:

>

> Dear Prof. Dai,

>

> I am eligible to apply for a sabbatical year again and was hoping to submit my application by the Oct. 2 deadline.

> If awarded, the university pays half salary for one AY — it would be for 2024-2025. Are there any possible grants or visiting professor position at your college that could provide towards the other half?

> Even if not, would you be willing to host me as a visiting scholar if I obtained the sabbatical?

> Of course both an invitation and/or an offer of financial support would make my application stronger and with good chances of success.

> In addition, submitting a draft of work in progress would again score in my favor with the sabbatical committee.

> Would you be willing to coauthor a simple abstract in the next 10 days that would outline a possible article that we could collaborate on together, possibly with prof. Feng?

>

> I will try to summarize again the novelty and the innovation of the current work:

>

> Overvelde 2017 showed riconfigurability but not flat-foldability (except cube #22) and many materials were actually rigid.

> Scarpa's bisection of prismatic extrusions provides flat-foldability but retains rigidity too.

>

> The above is innovative but may still look somewhate derivative.

>

> However, the same result looked at from a different perspective seems more elegant, efficient, and simplicity hiding in plain sight:

>

> It's noted that when extrusions are bisected, new prismatic byproduct polyhedra form at the vertexes of the original components of the tiling. For material #1 — the densest and most “energetic” — that shape is the rhombic dodecahedron, a non-uniform polyhedron very much flexible just by itself. Yet, when combined by simple translation with copies of itself, the system becomes rigid and yet can also flat-fold.

>

> Thus, the “discovery” is that flexible prismatic polyhedrons, such as the rhombic dodecahedron, become rigid when connected with copies of itself, yielding in this case the bistable metamaterial #1. The rule then is: find space-filling polyhedra whose faces are rhombuses. Simply extrude the faces (no split) and connect copies of this extruded

are rhombuses. Simply extrude the faces (no split) and connect copies of this extruded polyhedron edge to edge (the join is the original Scarpa bisection). Even the extruded cube, when distorted into a rhombohedron and joined with other copies to form a pyramid, becomes rigid even though it is very flexible just by itself.

>

> Both the honeycomb at the macro level (the folding) and the possible mechanism of the hinges could form the basis on one, possibly two articles?

>

> Do you think it would be possible to meet on zoom to discuss, perhaps also with Prof. Feng. Please forward to Prof. Feng if appropriate.

>

> With respect,

>

> Pino

>

> <D2B3F922-1D9B-42CA-9388-57B8CF3CC4CF.pdf>

>

>

>



**From:** Pino Trogu trogu@sfsu.edu  
**Subject:** Re: Visit  
**Date:** August 15, 2023 at 5:46 PM  
**To:** 冯慧娟(FENG Huijuan) fenghj@sustech.edu.cn  
**Cc:** Prof. Jian S. Dai jian.dai@kcl.ac.uk  
**Bcc:** Pino Trogu trogu@sfsu.edu

Dear Prof. Feng,

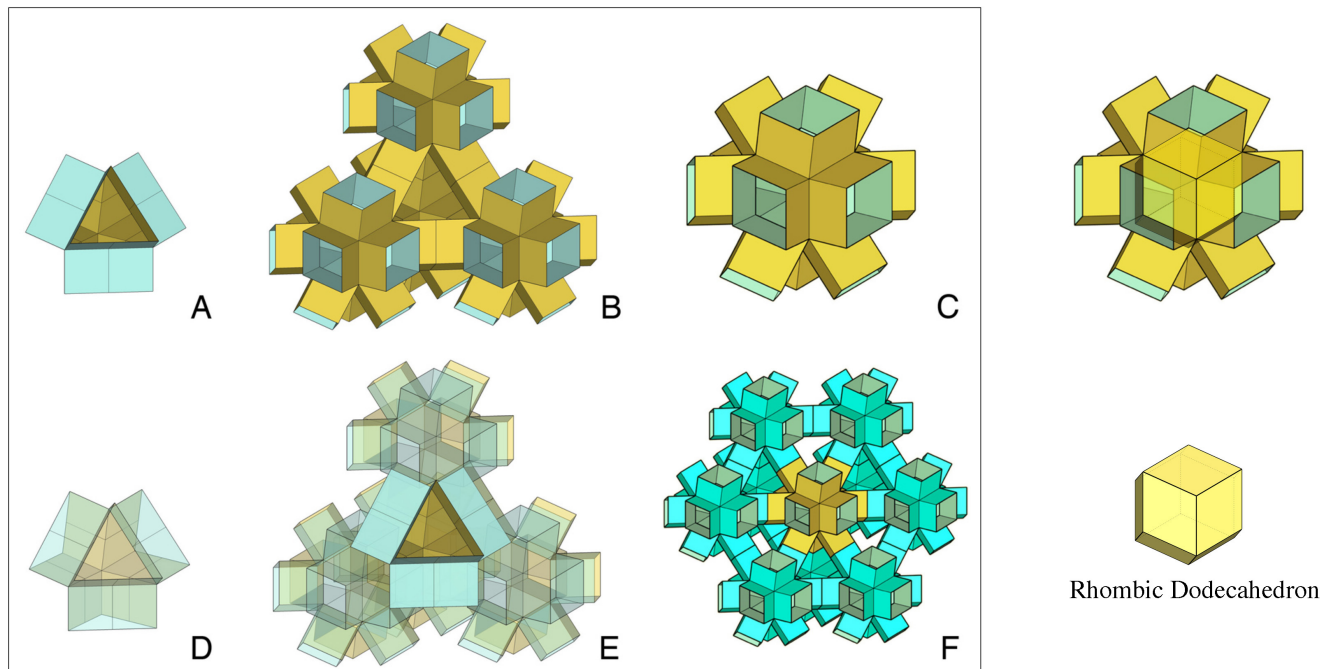
Thank you for looking at my materials. I very much appreciate your time and I look forward to your observations.

I attach two more illustrations showing how material #1 (extruded tetrahedra and octahedra) can be subsumed into just extruded rhombic dodecahedra after the former's extrusions are split and "push-fitted". Material #6 similarly yields rhomboedra. Both rhombic dodecahedra and rhombohedra are flexible if the faces are extruded and hollowed out, but they become rigid if connected to each other in a space-filling tiling. And yet they can also flat-fold...

Best regards,

Pino

ps: a bit of trivia but very interesting, this month's [cover article in Nature about lithium-metal batteries](#) reveals "the intrinsic deposition morphology of metallic Li to be that of a rhombic dodecahedron". This [press release](#) from UCLA describes the paper.



**Figure 11:** A “rhombic dodecahedral prismatic star” forms at each vertex neighborhood of the original tiling #1. This unit repeats periodically without changing orientation and connects to twelve other stars in the material by simple translations along the longitudinal axes of the prisms (F).

On Aug 12, 2023, at 3:58 AM, 冯慧娟(FENG Huijuan) <[fenghj@sustech.edu.cn](mailto:fenghj@sustech.edu.cn)> wrote:

Dear Prof. Trogu,

Thanks for sharing your wonderful work. I shall go through these materials. Looking forward to our potential collaboration.

Best regards,  
Huijuan

-----原始邮件-----

发件人: Pino Trogu<[trogu@sfsu.edu](mailto:trogu@sfsu.edu)>  
发送时间: 2023-08-12(周六) 16:05  
收件人: Prof. Jian S. Dai<[jian.dai@kcl.ac.uk](mailto:jian.dai@kcl.ac.uk)>  
抄 送: fenghj<[fenghj@sustech.edu.cn](mailto:fenghj@sustech.edu.cn)>  
主题: Re: Visit

Dear Prof. Dai,

Thank you so so much. My students will be thrilled to meet you and a collaboration with you and Prof. Feng would be fantastic. Very nice to meet you Prof. Feng!

I share here again the link where Prof. Feng can view some of the work and below I reprint the basic outlines of the study:

<https://res.trogu.com/liber/sharp/>

user: guest pass: go1984!

\* \* \*

The directory includes a very [rough draft](#) article describing a tetrahedron that is a bistable figure whose main feature is the bisection of its extruded sides (a 1996 invention by my teacher [Giorgio Scarpa](#)). This feature renders flexible and flat-foldable some prismatic metamaterials that are otherwise rigid, for example materials #1 (tetrahedra and octahedra) and #6 (tetrahedra and truncated tetrahedra) in [Overvelde et al 2017](#). See videos [a](#) and [b](#) for physical models of foldable material #1; [c](#) for its matlab simulation; and [d](#) for matlab simulation of material #6. Prof. Overvelde is aware of these variations and has offered support in the past.

There have not been many articles that have truly expanded on the concept since 2017, so there is an opportunity for an innovative approach.

I just found a 2021 article ([Xiao et al](#)) that actually shows the basic figure, albeit in a very hidden way, but I think the authors are not aware of its potential, because they describe it as having  $DOF = 0$ , but in fact when scaled, the flat-folding motion should be  $DOF = 1$  (see [4e](#) rightmost columns, and [8c](#).) and it should behave as shown in my material [#6](#) video.

I attach a few other elements for Prof. Feng to see. I apologize that they are a bit disorganized but I am available to connect directly should it be appropriate before Prof. Dai's visit on Sept. 8.

Warmest regards,

Warmest regards,

Pino

Pino Trogu  
Professor, School of Design  
San Francisco State University  
[trogu.com](http://trogu.com)  
[faculty.sfsu.edu/~trogu](http://faculty.sfsu.edu/~trogu)

On Aug 11, 2023, at 6:43 PM, Jian Dai <[jian.dai@kcl.ac.uk](mailto:jian.dai@kcl.ac.uk)> wrote:

Dear Pino

That is great. Thanks for inviting me to join. I look forward to the meeting on 8<sup>th</sup> with your students. I copy this email to my group young lecturer Huijuan Feng who is doing Bricard and classical mechanisms and applying to metamaterials. I think that is a great opportunity for us to work together.

Best wishes

Jian

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**From:** Pino Trogu <[trogu@sfsu.edu](mailto:trogu@sfsu.edu)>  
**Date:** Saturday, 12 August 2023 at 08:14  
**To:** Jian Dai <[jian.dai@kcl.ac.uk](mailto:jian.dai@kcl.ac.uk)>  
**Subject:** Re: review

Dear Prof. Dai,

On Friday Sept. 8 I have two students assistants at my studio helping me with the metamaterial project. I received a small grant so they will be helping me make the models one day a week for the academic year. If OK with you they will like to meet you as well, unless you prefer to visit alone or if you can only visit on Thursday 7.

Also, I attach the Rhino mechanism that Martin Pfurner from Austria had done in 2019 — his attempt to model the kinematics of the tetrahedron. He has not tried animations or computations yet but I thought I would share it, along with the illustrations I had assembled at the time to show the possible relationship.

Best,

Pino

On Aug 9, 2023, at 9:17 PM, Pino Trogu <[trogu@sfsu.edu](mailto:trogu@sfsu.edu)> wrote:

Prof. Dai,

May I invite you to have lunch together on one of those days, either at our place or in the neighborhood?

Also, on Sept. 7 I might have student appointments between 9 and 12, but I will know for sure that week.

Anyway, after lunch I will love to show you my latest models and get your advice about possible conferences and publications.

All the best,

Pino

On Aug 9, 2023, at 7:17 PM, Jian Dai <[jian.dai@kcl.ac.uk](mailto:jian.dai@kcl.ac.uk)> wrote:

Great, Pino

I shall be in San Francisco to visit you between 7-8 September

Best wishes

Jian

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**From:** Pino Trogu <[trogu@sfsu.edu](mailto:trogu@sfsu.edu)>

**Date:** Thursday, 10 August 2023 at 00:35

**To:** Jian Dai <[jian.dai@kcl.ac.uk](mailto:jian.dai@kcl.ac.uk)>

**Subject:** Re: review

Dear Prof. Dai,

Great to hear from you. Yes, I will be in San Francisco all those times except I teach on Sept. 6 which is a Wednesday (I teach Tue. and Wed. this semester). But I would still be free after 5 even on those days.

Let me know more as your trip nears, also if you need any assistance in regards to your stay or travel plans.

Looking forward,

Pino

On Aug 9, 2023, at 7:38 AM, Jian Dai  
<[jian.dai@kcl.ac.uk](mailto:jian.dai@kcl.ac.uk)> wrote:

Dear Pino

I am going to San Francisco on 23<sup>rd</sup>  
August and think of visiting you either  
on 24-25 August or on 6-8 September.  
Are you available then?

Best wishes

Jian

Professor Jian S Dai,  
Fellow of the Royal Academy of Engineering  
Member of Academia Europaea  
FREng, MAE, FIEEE, FASME, FRSA, FIMechE

Editor-in-Chief of Robotica (Est. 1983)  
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