〔 機械工学科 〕

〔 区　分　A 〕

吉川　貴士

The Digital Reminiscence Method: Effects on Dementia in Japanese Day Care Centers

Masayuki Nakamura*1, Takashi Yoshikawa*2, Kayo TANAKA*3, Mengyuan Liao*4, Noriaki Kuwahara*5
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Lecture Notes in Computer Science Vol. 9185, pp482-489, (2015.8)

When considering working with dementia patients in communities or welfare facilities, manpower problems and the existing caregiver's support system must be considered. It is a modern reality that many facilities often struggle while coping with dementia patients. However, as recent studies have reported, depending on the way dementia patients are cared for, it is possible to suppress problematic behavior such as violence, screeching, and/or wandering.

In order to assist dementia patients while using the ″digital reminiscence″ method, students, facility staff members, dementia patients and their families worked together in this study.

吉川　貴士

Effect of care gesture on transfer care behavior in elderly nursing home in Japan

Mengyuan Liao*1, Takashi Yoshikawa*2, Akihiko Goto*3, Tomoko Ota*4, Hiroyuki Hamada*5
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Lecture Notes in Computer Science Vol. 9185, pp174-183, (2015.8)

In this paper, care gesture effect on elder transfer care behavior between bed and wheelchair was investigated. A 'hypothesis' elder (a 80 kg co-operative female with 15 years of care occupation experience, assumed that the lower half body is paralyzed) was employed in both expert and non-expert caregiver's handling tasks. Both expert and non-expert's care gestures during transfer care process (hold up, turning, lower down) were recorded by three-dimensional motion capture system. In order to extract expert and non-expert care gesture's feature difference, motion analysis of caregiver's body exertions was also summarized by body gravity movement track, knee's flexion/extension, low-back bending situation. As a result, it could be concluded that expert master optimal care gesture to accomplish the transfer care work with reduced body loading and limited energy by taking full advantage of lower half body exertion.

吉川　貴士

Analysis of eye movement of caregiver concerning on transfer operation

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Lecture Notes in Computer Science Vol. 9184, pp58-65, (2015.8)

As well known, nowadays Japan is one of the several “super-ageing societies” all around the world. The aging of Japan is thought to outweigh all other nations, as the country is purported to have the high-est proportion of elderly citizens; 33.0% are above age 60, 25.9% are aged 65 or above, 12.5% aged 75 or above, as of Sep 2014. The in-creasing proportion of elderly people also had a major impact on in-creased burden for caregivers. Due to a shortage of expert nursing staff, training caregivers for long-term care facilities has also become a grow-ing concern. Therefore, in order to help speed up training process, one of the popular care processes “transfer operation” between bed and wheelchair was examined. In this study, elder staff's eye movements during transfer was measured and compared between expert, non-expert and beginner caregiver. Comparing with beginner without experience, caregivers with occupational experience were found to pay more attention on elder's body with longer eyes rested duration according to eye movement track. Especially, expert caregiver's skillful care process was also clarified, during which he put less time than non-expert to focus the objects such as bed, wheelchair and so on. Eye moving characteristic and difference between expert and non-expert suggested that transfer care assistance could be improved by instructing the caregivers to focus on specific parts of elder's body effectively.

吉川　貴士

A study of caregiver's waist movement comparison between expert and non-expert during transfer care

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Lecture Notes in Computer Science Vol. 9185, pp164-173, (2015.8)

As well know that caregivers employed in elderly nursing home suffer from low-back injuries/pain at a terrible rate worldwide, however there is little studies focusing on visual analysis of care works difference conducted by expert and non-expert caregivers. In current study, a ‘hypothesis’ elder was employed in both expert and non-expert caregiver's handling tasks. And two caregivers with different experience years were selected as subjects named as expert and non-expert, which were required to perform transfer care process for the same elder object. With three-dimensional motion analysis, non-expert's back pain cause was explained by waist up-down and horizontal plane movement, waist roundness, lower back bend angle and waist joint angle comparison to expert performance quantitatively. As a result, it could be concluded that expert kept straight upper body and stable waist motion in a smaller range during transfer care process which was considered as effective waist movement for back pain prevention in intensive heavy care works.

吉川　貴士

An investigation of caregiver's fatigue during nursing work in China

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Lecture Notes in Computer Science Vol. 9185, pp455-464, (2015.8)

In order to evaluate caregiver's fatigue during daily care work, an investigation was carried out in Chinese nursing house. 100 employees from four different nursing houses including day and night working shift were selected in random for sampling survey. And the fatigue situation was evaluated applying Japanese "subjective fatigue symptoms" (new edition of 2002) and "Tired body parts" questionnaires in field question-answer form. Collecting "subjective fatigue symptoms" questionnaire results were analyzed, which showed that caregiver's fatigue degree at the end of working day is more serious with larger scores than that of the beginning, especially caregiver in night shift displayed more fatigue in blurry vision and languidness. The aim of this work is to get a good knowledge of caregiver's fatigue situation basically and put forward some effective measures and necessary assisted device to adjust to Chinese nursing house development.

吉川　貴士

EMG Activity of Arms Muscles and Body Movement during Chucking in Lathe between Expert and Non-Expert

著者名

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Lecture Notes in Computer Science Vol. 9185, pp216-226, (2015.8)

This research is an extension of three related prior studies by the authors. In this current paper, the chucking behaviors (i.e. body movement and arm muscles contraction) of experienced and inexperienced lathe workers and the incidence of indentations as a result of different chucking behaviors were investigated. Prior to the experiments, four participants of different ages and lathing experience were recruited and equally divided into the expert and non-expert subjects. The findings showed that, in chucking, the experts required a mere twist of the shoulders and waist and considerable arm muscles contraction, in addition to a few brisk and forcible pullbacks (jerks) of the chuck key. The non-experts however exhibited significantly less arm muscles contraction but needed to lower their left knee and tilt the body leftward toward the ground. Despite their minimal arm muscles contraction, the non-experts' chucking method sometimes generated excessive gripping force on the jaw teeth and thereby caused indentations on the workpiece.

越智　真治

Flexural Properties of Bamboo fiber / PLA Composites

越智真治*

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Open journal of Composite Materials, Vol.5/3, pp.70-78, (2015.7)

This paper describes the flexural properties of biodegradable composites made using natural fiber and biodegradable plastics. Biodegradable composites were fabricated from bamboo fiber bundles and PLA (polylactic acid) resin. In this research, effect of molding temperature and fiber content on flexural properties of bamboo fiber reinforced composites was investigated. The flexural strength

of this composite increased with increasing fiber content up to 70%. The flexural strength of composites decreased at molding temperature of 180℃. Biodegradable composites possessed extremely high flexural strength of 273 MPa, in the case of molding temperature of 160℃ and fiber content of 70%.

〔 区　分　E 〕

鎌田　慶宣

3D プリンタを用いた吸音構造の実験的基礎研究

鎌田慶宣*1，柏尾知明*2，星野修人*3，島田貴史*4
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公益社団法人　日本自動車技術会　2015 年秋季大会学術講演会(2016 年 10 月 15 日)

吸音構造の寸法諸元や接合条件の異なる数種の MPP とハニカムコア試料を,新たに 3D プリンタを利用して造形し，音響インピーダンス管による垂直入射吸音率を実測し，その吸音機構を考察し，以下の知見が得られた.

(1) 3D プリンタで，新たに板厚 0.1[mm]までの薄い MPP とハニカムコアを造形することができ，将来的可能性として AM(Additive Manufacturing)技術で構造としての機能をもつ吸音体を設計製造する可能性の端緒が得られた.

(2) MPP とハニカムコアを接触させた場合は，両者を一体で結合した場合に比べて吸音率の帯域幅が大きく広がり，高い吸音率となる傾向がどのケースでも観測された．特に板厚が薄くなるほどそれが顕著になる．これは MPP の曲げ剛性が小さくなると MPP 前後の音圧差でハニカムコアと MPP の間に隙間を生じ,交番的な音圧で MPP がハニカムコアの端面に「振動的衝突」を繰り返し，音響エネルギーが消散するという仮説が立てられた.

(3) 「Helmholtz 共鳴」と「板の曲げ共振」が発生する振動数の目標を独立して設計可能とする円環状突起付き MPP を提案した．3D プリンタによる造形と吸音率の検証を行い，予測に沿った有意な結果が得られた.

谷口　佳文

金属製下肢装具用膝継手の耐久試験

福島航*1、谷口佳文*2
*1 新居浜工業高等専門学校生産工学専攻　*2 新居浜工業高等専門学校機械工学科
日本設計工学会　四国支部　平成２７年度研究発表講演会（徳島大学工学部)、2016 年 3 月

金属製下肢装具用膝継手は、膝上から足底に及び膝関節と足関節の動きを制御する装具に使用されている。この膝継手には、圧縮、曲げ、ねじり等の複雑な負荷が繰り返し作用するため耐久性が要求され、ＪＩＳでその試験方法が定められている。

本研究では、先の研究で開発した耐久試験装置を用いて繰り返し負荷試験を行い、膝継手可動部の「がた」の変化と耐久性の評価を行った。その結果、屈曲伸展方向の「がた」に変化は見られなかったが、それと直角方向の「がた」は負荷の繰り返しと共に、摩耗によって次第に増加する傾向が見られた。また、ＪＩＳで規定された１０万回の繰り返しでは破断は生じなかったが、さらに負荷を継続すると大腿支柱の曲がり部で疲労破壊を起こすことが明らかとなった。

下村　信雄

霜層計算モデルの基礎（その１）

下村信雄*1
*1 新居浜工業高等専門学校機械工学科
日本冷凍空調学会調査研究プロジェクト
「低温機器における着霜および除霜の基礎と応用」講演会,(2015.9.4)
霜層成長予測の概論として位置づけ、霜層成長の予測を主体に過去の着霜研究の概要を紹介する。また、１次元成長モデルでの霜層を「均質」する場合と「非均質」とする場合のモデルの差異による予測結果を紹介し、さらに簡易的な２次元成長モデルの結果を概説した。霜層成長のモデル化の基礎と、初期値や熱伝導率などのパラメーターの結果への依存性について議論した。

下村　信雄

霜層計算モデルの基礎（その２）

下村信雄*1
*1 新居浜工業高等専門学校機械工学科
日本冷凍空調学会調査研究プロジェクト
「低温機器における着霜および除霜の基礎と応用」講演会,(2015.12.3)
霜層の成長予測の手法が確立されておらず,霜層成長の物理的モデルを提案し,数値計算の結果,並びに,着霜の支配的パラメータについての実験から実験整理式を提示した。霜層成長の計算に使用した仮定,並びに,均質霜層成長モデルと霜密度が高さ方向に変化するとした非均質霜層成長モデルの数式等を説明した。

下村　信雄

霜層計算モデルの基礎（その３）

下村信雄*1
*1 新居浜工業高等専門学校機械工学科
日本冷凍空調学会調査研究プロジェクト
「低温機器における着霜および除霜の基礎と応用」講演会,(2016.3.9)
非均質霜層成長モデルによる霜層の成長予測プログラムについて、その使い方を詳細に説明した。さらに使用時の注意点や結果表示に関して説明した。

下村　信雄

低レイノルズ数領域におけるコルゲート熱交換器の研究

下村信雄*1
*1 新居浜工業高等専門学校機械工学科
日本設計工学会四国支部　平成２７年度 特別講演会・研究発表講演会,(2016.3.14)
熱交換器の高性能化のために，二重管式熱交換器の内管にコルゲート管を用いる．低レイノルズ数領域(Re250～3000)において，ストレート管およびコルゲート管について，解析および実験を行うことで伝熱性能の比較を行い、層流域において以下の結果を得た.
(1) コルゲート管を用いることで，伝熱性能を向上できる．(2) レイノルズ数が大きくなるに伴い，コルゲート管の優位性が大きくなる．(3) コルゲート管を用いることで,圧力損失が最大 2.1 倍になるため,

ポンプの動力を大きくする必要がある

吉川　貴士

「檀紙製造における刷毛さばきの考察」

松田光平*1、吉川貴士*1、中村成志*2、野島伸司*3

*1 新居浜工業高等専門学校機械工学科、 *2 新居浜工業高等専門学校生産工学専攻、 *3 マルホ発條工業(株)

日本機械学会　第 23 回機械材料・材料加工技術講演会　M&P2015　(2015.11)

周桑手すき和紙にちりめん状の表面加工を施すことで付加価値をつけた「檀紙」の製造における熟練者の刷毛さばきについて行程別に調べた結果、特徴的な結果を得ることができた。それらの結果について熟練者にヒアリングすることで、これまで、無意識に行っていた刷毛さばきに理由があることがあきらかになった。それら暗黙知を可視化し、コツとして非熟練者に伝えるべきものについて報告した。

吉川　貴士

The development of video training course containing human kinematic mechanism analysis for caregivers

Mengyuan LIAO*1 , Takashi YOSHIKAWA*2, Akihiko GOTO*3, Yuka TAKAI*3, Yomoko OTA*4, Hiroyuki HAMADA*5

*1 京都工芸繊維大学大学院先端ファイブロ専攻、 *2 新居浜工業高等専門学校機械工学科、 *3 大阪産業大学、 *4(株)中央ビジネス、 *5 京都工芸繊維大学大学院

ASME 2015 International Mechanical Engineering Congress & Exposition (2015.11)

In this paper, simple and easy to understanding video aiming to compare expert and non-expert's transfer care motion by human kinematic mechanism analysis just matched for 30 minutes training course requirement was made. The whole movie training material is consisted of 5 parts: questionnaire investigation answer from elder and caregiver, normal record movie comparison between expert and non-expert, corresponding body model motion simulation movie, transfer care process and different mechanics of movement analysis.As a result, caregivers' kinematic mechanism difference could be clarified that expert kept straight upper body and stable waist motion in a narrow working range with short working distance, especially with frequent utilization of lower limb's strength during lift-up, turning and sit stages with knee's flexion and extension in order to reduce the low back loading by waist bending motion. In a word, expert's proper care gesture made a positive effect on preventing low back pain issue in extensive transfer care works. Through video display in training course, nursing care staff could easily to get a good knowledge of care process differences between expert and non-expert caregiver by visual discrimination at a glance and understand expert's motion essential in deeper by quantitative movement analysis result.

Furthermore, video course application is convenient for repeated showing and enhancing beginner's memory and applied to real practice finally which not only shorten the training cycle and also reduce the possibility of waist damage. In a word, this paper was aimed to give the feedback to elder nursing care occupational site, help to improve and optimize beginner's care skill by making full use of a fixed daily training time effectively.

吉川　貴士

「手漉き和紙の製造における腰と首の連動性」

中村成志*1、今城彰彦*2、吉川貴士*3、濱田泰以*4

*1 新居浜工業高等専門学校生産工学専攻、　*2 京都工芸繊維大学大学院先端ファイブロ専攻、　*3 新居浜工業高等専門学校機械工学科、　*4 京都工芸繊維大学大学院

日本機械学会　2015 年度年次大会　(2015.9)

愛媛の周桑手漉き和紙の製造については、これまで秘伝が守られてきており、製造に関する文献がほとんどない。しかしながら、同地域おいて 100 名ほどいた職人が現在は 7 名となり、後継者育成は地域にとって重要な課題となってきた。そこで、熟練者の行程分けおよびそれら工程における身体挙動を把握し、長時間(休憩をはさみ)・一定の品質の保つ製造におけるコツを見出す。今回、腰と頸部の連動性について調べた結果を報告する。

吉川　貴士

Caregiver and patient's comfort investigation based on head motion behavior analysis during transfer care

Mengyuan LIAO*1 ,　Takashi YOSHIKAWA*2,　Akihiko GOTO*3,　Hiroyuki HAMADA*4

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6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015　(2015.7)

We investigated that elder patient's uneasy and uncomfortable feeling appeared accompanying with their head concussion in recorded motion movie. In this paper both caregiver and elder patient's head motion behavior in three-dimensional analysis was investigated and patient's uneasy reason and different care style of expert/non-expert caregiver were also clarified. As a result, expert's head motion acceleration's RMS value is larger than non-expert in Z direction (upper-down) in "stand" step during transfer care process, which was considered that expert could master power to hold elder patient to stand better in short time and avoid patient head's concussion. Moreover, both elder patient and caregiver's head motion acceleration differential (JERK)'s RMS value were also summarized and compared under expert and non-expert caregiver care situation. It is found that both patient and caregiver showed smaller JERK's RMS value in the case of expert's transfer care process, especially obviously big difference in elder patient. In a conclusion, little impact effect on elder patient's head was generated after expert caregiver's transfer care, in other words, patients' uneasy and uncomfortable feeling was explained quantitatively by head motion analysis.

吉川　貴士

The Digital Reminiscence Method: Effects on Dementia in Japanese Day Care Centers

Masayuki Nakamura*1, Takashi Yoshikawa*2, Kayo TANAKA*3, Mengyuan Liao*4, Noriaki Kuwahara*5

*1 新居浜工業高等専門学校生産工学専攻、　*2 新居浜工業高等専門学校機械工学科、*3(社)すいよう会、　*4 京都工芸繊維大学大学院先端ファイブロ専攻、*5 京都工芸繊維大学大学院

17th International Conference on Human-Computer Interaction (2015.8)

When considering working with dementia patients in communities or welfare facilities, manpower

problems and the existing caregiver's support system must be considered. It is a modern reality that many facilities often struggle while coping with dementia patients. However, as recent studies have reported, depending on the way dementia patients are cared for, it is possible to suppress problematic behavior such as violence, screeching, and/or wandering.

In order to assist dementia patients while using the "digital reminiscence" method, students, facility staff members, dementia patients and their families worked together in this study.

吉川　貴士

EMG Activity of Arms Muscles and Body Movement during Chucking in Lathe between Expert and Non-Expert

Porakoch Sirisuwan*1, Hisanori Yuminaga*2, Takashi Yoshikawa*3, Hiroyuki Hamada*4
*1 京都工芸繊維大学大学院先端ファイブロ専攻、 *2 関西医療学園専門学校、*3 新居浜工業高等専門学校機械工学科、 *4 京都工芸繊維大学大学院

17th International Conference on Human-Computer Interaction (2015.8)

This research is an extension of three related prior studies by the authors. In this current paper, the chucking behaviors (i.e. body movement and arm muscles contraction) of experienced and inexperienced lathe workers and the incidence of indentations as a result of different chucking behaviors were investigated. Prior to the experiments, four participants of different ages and lathing experience were recruited and equally divided into the expert and non-expert subjects. The findings showed that, in chucking, the experts required a mere twist of the shoulders and waist and considerable arm muscles contraction, in addition to a few brisk and forcible pullbacks (jerks) of the chuck key. The non-experts however exhibited significantly less arm muscles contraction but needed to lower their left knee and tilt the body leftward toward the ground. Despite their minimal arm muscles contraction, the non-experts' chucking method sometimes generated excessive gripping force on the jaw teeth and thereby caused indentations on the workpiece

谷脇　充浩

液体サイクロンを用いた微細繊維の分離・捕集

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日本設計工学会　四国支部　平成27年度研究発表講演会　2016年3月

工場排水や生活排水などにも多く含まれる微細な繊維状混入物に注目し，円筒部と円錐部から構成される接線型液体サイクロンを用いた微細繊維の分離・捕集において，液体サイクロン形状が分離・捕集に与える影響を調べた．その結果，円筒部を長くすることで低速域での捕集率が高くなること，上昇管内径を小さくすることで形成される気柱が細くなり捕集率が向上することが分かった．

玉男木　隆之

Longitudinal Wave Propagation Including High Frequency Component in Viscoelastic Bars

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2015 SEM Annual Conference and Exposition on Experimental and Applied Mechanics (2015－6)

The viscoelastic properties of polymer materials were examined over a wide range of frequencies. The longitudinal waves propagating in the solid and hollow cylinders were discussed using the Pochhammer-Chree theory. The attenuation and the dispersion properties within the frequency of around 200kHz were evaluated by using the ultrasonic transducers having several characteristic frequencies. Consequently, it was found that the second-mode vibration as well as the first-mode should be considered in the high frequency region. It was also confirmed that the second-mode vibration influenced deeply as the radial thickness became thin.

今西　望

エアシリンダを用いたチューブ型柔軟ロボットの開発

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第16回 計測自動制御学会 システムインテグレーション部門 講演会 SI2015, 2015年12月16日

従来のロボットは，昆虫などの外骨格生物のように外側に堅いフレームを持っているものが多い．堅いフレームのロボットは，ヤコビ法などに基づく軌道計画で制御するのには大変都合が良いが，ロボット自身の衝突による自損の他，人間の生活空間での事故が心配される．本研究では，１つ１つの剛性の高い複動式エアシリンダを，柔軟性を持つゴム関節で多数連結した新しいロボットの構造を提案し，実際の試験機の製作を行った．そして，エアシリンダにエア圧を加えることで，ロボットの伸縮の実験を行い，その実現性を確認した．

今西　望

転がりマスダンパの研究

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日本機械学会中四国講演会　第54期総会・講演会, 2016年3月9日

機械などの構造物の振動を抑える装置として，動吸振器が用いられることがあるが，動吸振器による制振にはバネやダッシュポットなどの機械要素が必要であり，高コストや経年劣化が問題となる．本研究では，円筒内面を転がるコロの往復振動を動吸振器として活用することに着目し，コロの形状を多角形に変更することで，システムの減衰率を自由に設計する方法を提案した．提案した設計方法は，数値計算によってその性能の評価した．