

Mechanical Engineering in Ancient Egypt, Part XXXVIII: Non-stone, Non-wooden Human Statues Industry

Galal Ali Hassaan

Department of Mechanical Design & Production, Faculty of Engineering,
Cairo University, Giza, Egypt

Abstract:

This paper is the 38th research paper in a series investigating the evolution of mechanical engineering in ancient Egypt. It tries to achieve this purpose through investigating the production of ancient Egyptians non-stone, non-wooden statues during the era from Predynastic to Late Period. Each stone statue is presented chronically with present location if known and with engineering analysis showing its creativity. The presentation is classified according to the material used in producing the statues.

Keywords — Mechanical engineering, ancient Egypt; non-stone; non-wooden statues

I. INTRODUCTION

Ancient Egyptians were pioneers in resource planning and using all available raw materials in their domestic and engineering applications. This research paper focuses on this fact in the industry of human statues using non-stone, non-wooden materials during a history span from Predynastic to Late Period.

Smith (1960) in his book about ancient Egypt as represented in the Museum of Fine Arts at Boston presented small statuettes produced during the Predynastic Periods from mud, clay and ivory. He presented also an ivory statue for King Menkaure of the 4th Dynasty, faience shawabties for Pharaoh Thutmose IV of the 18th Dynasty [1]. Branchi (1989) in his research paper about the Egyptian metal statuary during the Third Intermediate Period presented a hollow cast statue, a hollow-cast bronze statue for Pharaoh Osarkon I of the 21st Dynasty, a hollow-cast bronze with gold inlay for Amun, a hollow-cast bronze statue for a Queen from the 25th Dynasty, a Kushite female bronze figure from the 25th Dynasty, all in display in the Brooklyn Museum at NY [2]. Tassie (2008) in her Ph. D. Thesis about the social and ritual contextualisation of an Egyptian hair and hairstyle presented a copper statue for King Pepi I of the 6th Dynasty, ivory and clay figurines from the

Predynastic Periods, ivory and lapis lazuli figurines from Hierakonpolis, ivory figurine from Abydos and ivory figurines from the 1st Dynasty [3].

Koehler (2010) presented a number of clay and ivory figurines from the Prehistory Periods of ancient Egypt [4]. Sourouzian (2010) in his book chapter about the Old Kingdom sculpture presented the ivory statuette of King Khufu of the 4th Dynasty, two copper statues of King Pepi I of the 6th Dynasty [5]. Gravett (2011) in her Ph. D. Thesis about the analysis of selected Egyptian bronze artifacts in the National Cultural History Museum stated that the museum collections included five bronze figures for Osiris. She analysed in details a large gilded bronze statue of Osiris from the 12th Dynasty [6]. Wikipedia (2015) wrote an article about bone carving clarifying its use in the Prehistoric era of ancient Egypt where many venus figurines were carved from bone [7].

Hassaan (2016,2017) studied the evolution of mechanical engineering in ancient Egypt through investigating the industry of human wooden statues during the Predynastic to Late Periods [8,9] and the human stone statues industry from Predynastic to Late Periods [10-14]. Wikipedia (2017) wrote an article about women in ancient Egypt and presented a bronze statue for a woman from the 22nd Dynasty in display in the Egyptian Museum at Berlin [15].

II. BONE HUMAN STATUES

Bone was the first raw material available easily for the ancient Egyptian to produce some of his needs including statuettes. The ancient Egyptian succeeded to carve bone from more than 5600 years. Here are some examples of his of his bone statuettes produced during th era of Naqada I (4000-3600 BC):

- Fig.1 shows a figurine of a woman carved from bone during Naqada I of the Predynastic Period (4000-3500 BC) and in display in the British Museum at London [16]. Its height is 110 mm and the designer showed the lady putting both hands on her waist, wearing a headdress with painted horizontal bands, wearing a decorated panty and wearing a lapis lazuli eye glasses !! as clear in the zoomed view in Fig.1.



Fig.1 Bone figurine from Naqada 1 [16].

- The second example of bone statues is a woman figurine from Naqada 1 in display in the British Museum and shown in Fig.2 [17]. The designer showed the lady standing and her hands are both set vertically. She has no hair nor headdress and wearing only a decorated panty. The left hand and part of the face are broken.



Fig.2 Bone figurine from Naqada 1 [17].

III. IVORY HUMAN STATUES

Ivory is a hard, white material from the tusks (traditionally elephant's) and teeth of animals, that can be used in art or manufacturing [18]. Ancient Egyptians knew ivory from very early times. They used it in producing figurines from more than 6000 years. Here are some examples of using ivory in producing statuettes and statues up to the New Kingdom of ancient Egypt.

- The first example is an ivory figurine for a woman and her child from Badari culture (4400-4000 BC) in display in the Neues Museum at Berlin and shown in Fig.3 [19]. Even though, ivory has a moderate hardness, the carver could produce the many details for a standing lady carrying a child with primitive tools more than 6000 years ago. The lady was shown holding her child by her left hand on his waist and her right hand on his left leg.
- The second example is an ivory statuette for King Khufu, the second Pharaoh of the 4th Dynasty (2589-2566 BC) in display in the Egyptian Museum at Cairo and shown in Fig.4 [20]. The height of the statuette is 75 mm and the King was shown wearing a Modius Crown. The carver within the small

space available of the statuette could carve the King face with very high professionalism.



Fig.3 Ivory figurine from Badari [19].



Fig.4 Ivory statuette of King Khufu [20].

- The third example is a young boy figure of 142 mm height from the 6th Dynasty (2345-2181 BC) credited to De Agostini and shown in Fig.5 [21]. The carver showed the boy striding, completely necked and putting one of his fingers on his mouth. The statuette was nicely carved with very smooth surfaces and wonderful details. The hair, eyes and eyebrows were painted.
- The fourth example is an ivory statue for a female from the Old Kingdom (2686-2181

BC) credited to De Agostini and shown in Fig.6 [22]. The designer showed the woman standing, wearing a medium length Tunic and a long decorated (painted) headdress. One of the hands is extending downward, while the other is on her chest underneath the Tunic.



Fig.5 Figure of a boy from the 6th Dynasty [21].



Fig.6 Statue of a woman from the 6th Dynasty [22].

- The fifth example is a painted ivory statuette of a nude girl from the 18th Dynasty (1543-1292 BC) in display in the Brooklyn Museum of New York and shown in Fig.7 [23]. The designer showed the girl striding with her right hand extending downward and her left hand on her chest. She is completely necked and putting something on her head, may be a perfume cone or something else. The face and body are

professionally carved with painting the hair, eyes and eyebrows.



Fig.7 Statuette of a nude girl from the 18th Dynasty [23].

- The sixth example is a 105 mm ivory statuette for a nude girl from the 18th/19th Dynasties credited to De Aqostini and shown in Fig.8 [24]. The designer again showed the girl completely necked except a nicely decorated headdress. The zoomed image depicts the beauty of the girl face. The carving of the whole state is more than wonderful and one can imagine it was carved using modern CNC machines. In the same time it reflects the glory of the 18th and 19th Dynasties of ancient Egypt.



Fig.8 Statuette of a nude girl from the 18th/19th Dynasties [24].

IV. FAIENCE HUMAN STATUES

Faience is the conventional name for fine **tin-glazed pottery** on a delicate pale buff **earthenware** body [25]. The ancient Egyptians knew faience and produced some products from it including statuettes as will be illustrated in the following examples from the New and Late Periods:

- The first example is a faience sphinx for Amenhotep III, the 9th Pharaoh of the 18th Dynasty (1391-1353 BC) in display in the Metropolitan Museum of Art and shown in Fig.9 [26]. The designer showed the Pharaoh wearing a Nemes headdress with Cobra on its front with thin tall beard and holding two offering pots in both hands.



Fig.9 Faience sphinx of Amenhotep III [26].

- The second example is a 70 mm faience statuette of a Priest from the 18th Dynasty (1479-1458 BC) shown in Fig.10 [27].



Fig.10 Faience statuette of a Priest [27].

It takes the shape of classical stone block statues appeared during the 12th Dynasty and continued up to the Late Period [8,14]. It is of the design of putting both arms over the knees above the Schenti. The Priest is wearing a Khat headdress. This small statuette has an estimated sale price of \$ 10000-15000 [27].

- The third example is a female figurine from the New Kingdom (1550-1077 BC) in display in the Louvre Museum at Paris and shown in Fig.11 [28]. The designer showed the woman standing with both hands extending downward. He used a black colour to identify the short hair of the woman, her eyes, eyebrows, two necklaces, panty and decorations on hair waist and legs.

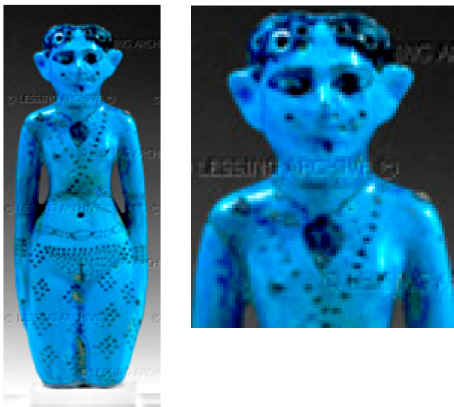


Fig.11 Faience figurine from New Kingdom [28].

- The fourth example is a female statue from the 26th Dynasty found within the funerary objects of six tombs excavated in the west bank of the River Nile near Aswan [29].



Fig.12 Female faience statue from the 26th Dynasty [29].

It seems that the faience statue is for an old Royal woman because the designer showed her wearing a Crown above the long headdress. She is also wearing bracelets on her arm and wrist.

V. TERRACOTTA HUMAN STATUES

Terracotta is a clay-based unglazed or glazed ceramic, where the fired body is porous [30]. As a local easily obtained raw material, ancient Egyptians used terracotta in producing some of their statues since very early times (more than 5400 years). We have two examples of using this material in human statues production:

- The first example is a 292 mm female figurine from Naqada II (3500-3400 BC) in display in the Brooklyn Museum and shown in Fig.13 [31]. The designer showed the lady wearing a painted long Schenti down to her feet and raising her hands.



Fig.13 Female figurine from Naqada II [31].

- The second example is a mourner woman from the 18th Dynasty in display in the Louvre Museum and shown in Fig.14 [32].



Fig.14 Mourner woman from the 18th Dynasty [32].

The designer showed the lady putting her right hand on her head with clear sadness signs on her face. She has a black hair and a black scarf around her neck.

VI. COPPER HUMAN STATUES

The ancient Egyptians new copper from times starting from 4000 BC (during Naqada I Period) [33]. The copper statues available belongs to King Pepi I, the 3rd King of the 6th Dynasty and are presented as follows:

- The first example is a small copper statue of the King found inside a life-size copper statue. The statue is shown in Fig.15 [34]. The statue is hollow and the King was shown striding wearing a short Schenti and a Cap headdress as clear in the zoomed image of Fig.15. The design and production of the statue is more than excellent.

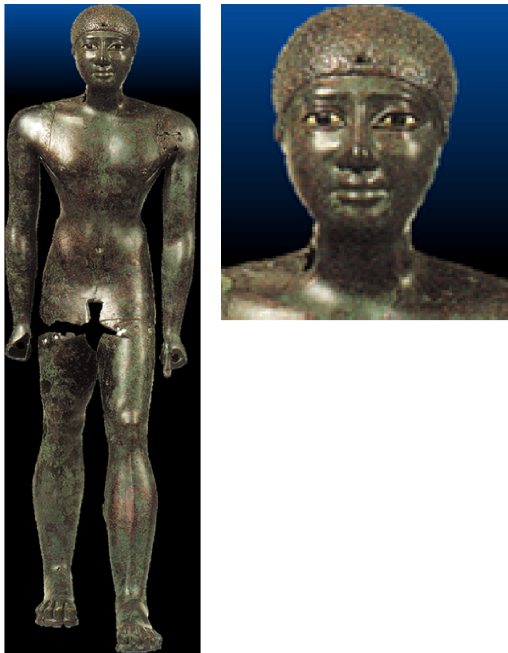


Fig.15 Small copper statue of King Pepi I [34].

- The second example is a life-size copper statue for King Pepi I in display in the Egyptian Museum at Cairo and shown in Fig.16 [35]. The designer showed the King striding, wearing a small Schenti and a Cap headdress and holding a long bar by his left palm and an object in his right palm. The eye is inlaid by limestone and obsidian.



Fig.16 Copper statue of King Pepi I [35].

- The third example is a 152 mm height copper kneeling statue of King Pepi I in display in the Brooklyn Museum and shown in Fig.17 [36]. The designer showed the King wearing a short Schenti with front tail and a decorated Nemes Headdress and offering two pots, one in each palm. The designer succeeded to produce the copper statue with different colors for the Schenti, the Nemes, the eyes and the eyebrows. This artefact indicates how the pioneer engineers could master using copper in constructing statuettes from more than 5000 years.



Fig.17 Kneeling copper statue of King Pepi I [36].

VII. BRONZE HUMAN STATUES

The ancient Egyptians have known the bronze material as an alloy replacing the copper material to improve its mechanical properties since 2700 BC during the Old Kingdom [33]. Bronze statues appeared during the New Kingdom, Third Intermediate and Late Periods as will be illustrated by the following examples of bronze statues:

- The first example is a bronze statue for Meryetmut from the 18th Dynasty in display in the Louvre Museum and shown in Fig18 [37]. She designer could decorate the whole statue showing the woman wearing an elaborated half-sleeved Tunic, decorated headdress and a wide pectorals. Her face is painted black and she is raising her forearms to the level of his waist.



Fig.18 Bronze statue of Meryetmut [37].

- The second example is a bronze statue for Seti I, the 2nd Pharaoh of the 19th Dynasty (1290-1279 BC) from Memphis of Lower Egypt in display in the Metropolitan Museum and shown in Fig.19 [38]. The designer showed the Pharaoh striding, having a thin long beard, wearing a decorated short Schenti and a compound headdress with a Cobra on its front.

- The third example is a 152 mm height statue for Imhotep, a Vizier and Architect of King Djoser manufactured from bronze during the 23rd Dynasty of the Third Intermediate Period (773-769 BC) in display in the Metropolitan Museum of Art and shown in Fig.20 [39]. The designer showed him setting, putting his hands on his thighs, wearing a long Schenti and a Cap headdress as clear in the zoomed image. Both statuette and seat are from bronze indicating how the old Egyptians could master the technology of bronze casting from more than 2750 years.



Fig.19 Bronze statue of Seti I [38].

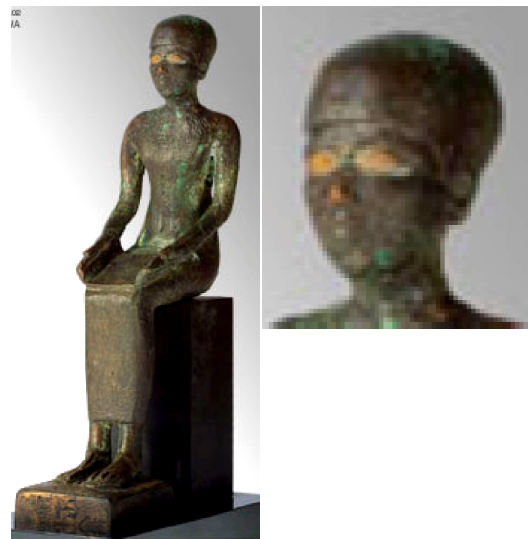


Fig.20 Bronze statue of Imhotep [39].

- The fourth example is a kneeling bronze statue for Necho II, the 2nd Pharaoh of the 26th Dynasty of ancient Egypt (610-595 BC) in display in the Brooklyn Museum and shown in Fig.21 [40]. The designer showed the Pharaoh kneeling with both hands about 100 mm above his thighs, wearing a short decorated Schenti and a decorated Nemes headdress with Cobra on its front. This statue represents the top quality in using bronze in producing statues. There are too many details complicating the statue design, but the ancient Egyptians did it with high production quality may be available nowadays only using Computerized machines !!.



Fig.21 Bronze statue of Necho II [40].

- The fifth example is a 110 mm height bronze statuette for Amasis II, the 5th Pharaoh of the 26th Dynasty (570-526 BC) in display in the Metropolitan Museum of Art and shown in Fig.22 [41]. The designer showed the Pharaoh kneeling and holding an offering pot in each hand, wearing a short

precious-metal-inlaid Schenti with front tail and a decorated Nemes headdress with Cobra on its front. Again, the statue reflects the top technology of manufacturing bronze statues in the 26th Dynasty.



Fig.22 Bronze statue of Amasis II [41].

- The sixth example is a bronze statue of a woman from the 26th Dynasty, reign of Pharaoh Necho II in display in the Metropolitan Museum of Art and shown in Fig.23 [42]. The designer showed the woman relatively necked with only a decorated headdress and a wide pectoral, putting her left hand on her right breast and her right hand extending fully with straight fingers. Even though, this is a metallic material not a stone or wood, the designer tried all his best to show the beauty of the woman. .

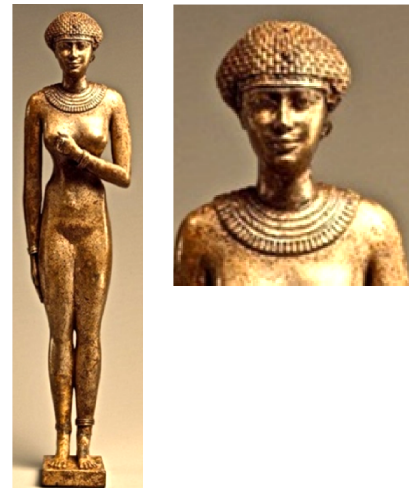


Fig.23 Bronze statue of a woman from the 26th Dynasty [42].

VIII. GOLD HUMAN STATUES

The ancient Egyptians new gold mining from more than 6000 years and gold artefacts were discovered dated to about 3500 BC [43], i.e. to the end of Naqada I. We have examples of golden statues from the golden age of the New Kingdom presented as follows:

- The first example is a two golden statuettes for Tutankhamun, the 13th Pharaoh of the 18th Dynasty (1332-1323 BC) in display in the Egyptian Museum at Cairo and shown in Fig.24 [44]. The mechanical designers showed the Pharaoh striding, holding a Crook in his left hand, wearing a Schenti with long belt, a sandal and a Crown. One of the statuettes with the Upper-Egypt-Crown (to the left) and the other with the Lower-Egypt-Crown (to the right) with Cobra on the front of the Crown. The eyes and eyebrows may be outlined by precious or semi-precious stones.



Fig.24 Gold statuettes of Pharaoh Tut [44].

- The second example is again for the rich Pharaoh Tutankhamun. It is a two life-size gold statues for the Pharaoh in display in the Egyptian Museum at Cairo and shown in Fig.25 [45]. Here, the designer showed the Pharaoh having a dark blue skin may be through using semi-precious stones (or even painting), wearing a Schenti with trapezoidal belt, wearing a Khat in the left statue and a Nemes in the right statue with Cobra on the front of each of them and holding a mace in his right hand and a spear in his left hand. The Pharaoh is wearing also a wide pectoral, a necklace and bracelets on his arm and wrist.



Fig.25 Gold statuettes of Pharaoh Tut [45].

- The third example is a golden statue for Queen Tuya, wife of Pharaoh Seti I and mother of the Great Pharaoh Ramses II of the 19th Dynasty in display in the Egyptian Museum at Cairo and shown in Fig.26 [46]. The designer reflected the wealth of the Royal and strong family of the 19th Dynasty. The Queen is wearing an elaborated headdress decorated from inside and outside, a wealthy wide pectorals and a coloured Tunic. The multi colours in the statue means that the designer used precious or semi-precious stones besides the gold in producing this valuable statue.



Fig.25 Gold statue of Queen Tuya [46].

- The fourth example is a 175 mm height golden statue for Amun produced during the 22nd Dynasty of the Third Intermediate Period (945-712 BC) in display in the Metropolitan Museum of Art and shown in Fig.26 [47]. The designer shown Amun wearing a medium Schenti, a Modius Crown, having a long thin beard, holding a sickle in his right hand and the ankh in his extending left hand. The old Egyptians had the mechanical technology to manufacture this complex-man-full-size statue from gold either using metal-sheet pressing or metal casting more than 2700 years !.

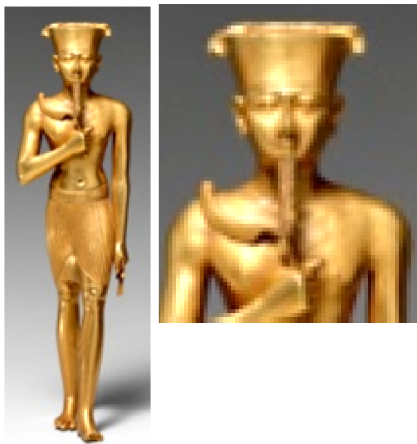


Fig.26 Gold statue of Amun [47].

IX. SILVER HUMAN STATUES

The ancient Egyptians used silver as a raw material to produce human statues during the 26th Dynasty of the Late Period (664-525 BC). We have two example authorizing this fact:

- The first example is a silver statue for a Royal woman with the Cartouche of Neco II, the 2nd Pharaoh of the 26th Dynasty (610-595 BC) in display in the Metropolitan Museum of Art and shown in Fig.27 [48]. The designer showed the woman wearing a decorated Cap headdress and a pectoral. The Cartouche of the Pharaoh is clear on her right hand in the zoomed image of Fig.27. The technique used needs more close investigation to see if it was a silver-casting process or a pressing process.

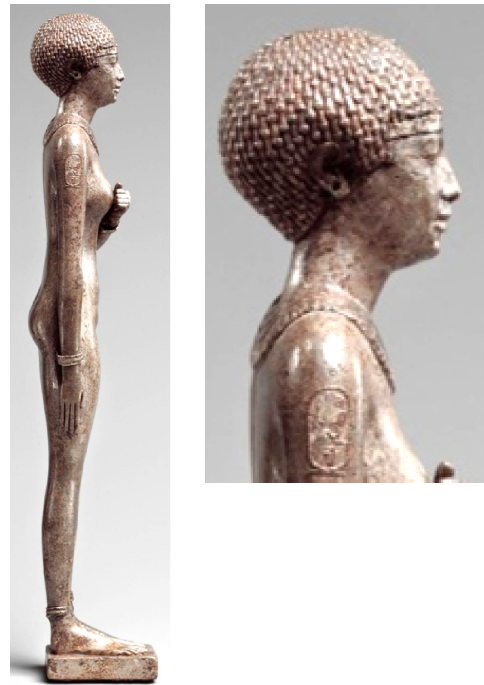


Fig.27 Silver statue of a woman from the 26th Dynasty [48].

- The second example is a 240 mm gold-plated silver figure for Amun-Ra from the 26th Dynasty in display in the British Museum and shown in Fig.28 [49]. The designer showed Amun-Ra striding while holding a short stick in his left hand and an object in his right hand, wearing a short Schenti, wide pectoral and a Double-reed Crown. The silver statue is plated by gold leafs at the Crown, pectoral and Schenti.



Fig.28 Silver figure of Amun-Ra from the 26th Dynasty [49].

since the time of Naqada II (more than 5400 years ago). A figurine from this period authorized using the long Schenti as a ladies dress from this early time.

- The statues designers and technicians succeeded to translate the human feeling and character to their statues.
- Regarding metals as raw materials for the statues industry, they used copper, bronze, gold and silver.
- They produced valuable gold statues in small size and life size.
- They achieved production of very complex designs using copper, bronze and gold.
- Metallic statues were produced in standing, striding, kneeling and setting positions.
- They used semi-precious stones to act as functional parts in their designs.
- They could generate wonderful statue designs through decoration and inlay.

X. CONCLUSIONS

- Ancient Egyptians were pioneers in producing all types of human statues.
- They used most available-reasonable materials around them to produce statues sustained environmental effects for thousands of years.
- They could carve animal bone and produce nice figurines since Naqada I of the Predynastic Period.
- Most of their women figurines in the Predynastic Period appeared with panty.
- They could produce complex figurines using ivory since the Badari culture (more than 6000 years).
- They carved an ivory statuette for King Khufu of the 4th Dynasty.
- They continued to use ivory in the statuettes industry through the 6th, 18th and 19th Dynasties of ancient Egypt.
- They produced wonderful sphinx from blue faience during the 18th Dynasty, block statuette and standing figurine during the New Kingdom and up to the 26th Dynasty of the Late Period.
- The ancient Egyptians used terracotta as a raw material for the human-statues industry

REFERENCES

1. *W. Smith, Ancient Egypt as represented in the Museum of Fine Arts, Boston, Museum of Fine Arts, Boston, 1960.*
2. *R. Bianchi, Egyptian statuary of the Third Intermediate Period (1070-656 BC), Symposium on Small Bronze and Sculpture from the Ancient World, The J. Paul Getty Museum, California, 16-19 March, 1989.*
3. *G. Tassie, The social and ritual contextualisation of ancient Egyptian hair and hairstyle from the Protodynastic to the end of the Old Kingdom, Ph.D. Thesis, University College London, Institute of Archaeology, January 2008.*
4. *E. Koehler, Prehistory in A. Lloyd (Editor), A companion to ancient Egypt, Wiley-Blackwell, pp.25-47, 2010*
5. *H. Sourouzian, Old Kingdom sculpture, in A. Lloyd (Editor), A companion to ancient Egypt, Wiley-Blackwell, pp.853-881, 2010*
6. *V. Gravett, A critical analysis of selected Egyptian bronze artefacts in the National Cultural History Museum, Master of Arts Thesis, University of South Africa, February 2011.*
7. *Wikipedia, Bone carving, http://wikipedia.org/wiki/Bone_Carving, 2015.*
8. *G. A. Hassaan, Mechanical engineering in ancient Egypt, Part XXXI: Human wooden stone statues (Predynastic to 13th Dynasty), World Journal of Engineering Research and Technology, vol.2, issue 6, pp.109-124, 2016.*
9. *G. A. Hassaan, Mechanical engineering in ancient Egypt, Part XXXII: Human wooden stone statues (New Kingdom*

- and Late Period), *International Journal of Advanced Research in Management, Architecture, Technology and Engineering*, vol.2, issue 11, pp.1-6, 2016.
10. G. A. Hassaan, *Mechanical engineering in ancient egypt, Part XXXIII: Stone statues industry (Predynastic to Old Kingdom)*, *International Journal of Recent Engineering Science*, vol.30, pp.5-16, December 2016.
 11. G. A. Hassaan, *Mechanical engineering in ancient egypt, Part XXXIV: Stone statues industry (11th to 17th Dynasties)*, *International Journal of Engineering and Techniques*, vol.2, issue 6, pp.171-177, 2016.
 12. G. A. Hassaan, *Mechanical engineering in ancient egypt, Part XXXV: Human stone statues in the 18th Dynasty*, *World Journal of Engineering Research and Technology*, vol.3, issue 1, pp.1-15, 2017.
 13. G. A. Hassaan, *Mechanical engineering in ancient egypt, Part XXXVI: Human stone statues in the 19th and 20th Dynasties*, *International Journal of Advancement in Engineering Technology, Management and Applied Science*, vol.3, issue 12, pp.106-116, 2016.
 14. G. A. Hassaan, *Mechanical engineering in ancient egypt, Part XXXVII: Human stone statues (Third Intermediate and Late Periods)*, *International Journal of Recent Engineering Science*, vol.31, pp.1-11, January 2017.
 15. Wikipedia, *Women in ancient egypt*, www.en.wikipedia.org/wiki/Women_in_ancient_Egypt, 2017.
 16. *Archaic Wonder*, *Naqada bone figure of a woman*, <http://archaicwonder.tumblr.com/post/111511992118/naqada-bone-figure-of-a-woman-upper-egypt-early>, 2016
 17. K. Prible, *Female figure in carved bone, Naqada I*, <https://www.pinterest.com/pin/295900637997159035/>
 18. Wikipedia, *Ivory*, www.en.wikipedia.org/wiki/Ivory, 2017.
 19. E. Stephens, *Woman and child figurine, Badari culture*, <https://www.pinterest.com/pin/321163017155167035/>
 20. Ancient Egypt, *Ivory statuette of Kheops*, <http://www.ancient-egypt.org/history/old-kingdom/4th-dynasty/kheops/kheops-statuette/ivory-statuette-of-kheops.html>, 2016
 21. Getty Images, *Figure of young boy, painted ivory*, <http://www.gettyimages.com/detail/photo/figure-of-young-boy-painted-ivory-statuette-high-res-stock-photography/185737085>
 22. Getty Images, *Female figure, ivory statue, Old Kingdom*, <http://www.gettyimages.com/detail/photo/female-figure-ivory-statuette-from-abu-rawash-high-res-stock-photography/185734928>, 2017
 23. C. Marsh, *Painted ivory statuette of a nude girl, 18th Dynasty*, <https://uk.pinterest.com/pin/213076626100258241/>
 24. Getty Images, *Female nude statue in ivory, 18th-19th Dynasty*, <http://www.gettyimages.com/detail/photo/female-nude-statuette-in-ivory-height-10-5-cm-high-res-stock-photography/185736707>, 2017
 25. Wikipedia, *Faience*, www.en.wikipedia.org/wiki/Faience, 2016,
 26. Bible History, *Sphinx of Amenhotep III, Dynasty 18*, http://www.bible-history.com/ancient_art/met/egypt/Sphinx_of_Amenhotep_III.html, 2001
 27. *Live Auctioneers*, *Ancient Egyptian faience statue of Priests*, https://new.liveauctioneers.com/item/32001746_ancient-egyptian-faience-statuette-of-priests
 28. *Warboar Word Press*, *Tattooing in ancient Egypt and Mesopotamia*, <https://warboar.wordpress.com/2013/10/02/sss/>, 2013
 29. *Ancient Origins*, *Six tombs containing mummies belonging to elite figures of 26th Dynasty unearthed in Egypt*, <http://www.ancient-origins.net/news-history-archaeology/six-tombs-containing-mummies-belonging-to-elite-figures-26th-dynasty-020387>, 2016
 30. Wikipedia, *Terracotta*, <https://en.wikipedia.org/wiki/Terracotta>, 2017.
 31. *Brooklyn Museum*, *Female figure*, <https://www.brooklynmuseum.org/opencollection/objects/74225>
 32. U. Merete, *Egyptian terracotta statue of a mourner*, <https://www.pinterest.com/pin/372250725420084054/>
 33. A. Ead, *History of science in egypt*, *IOSR Journal of Humanities and Social Science*, vol.19, issue 1, pp.94-97, 2014.
 34. *Ancient Egypt*, *Small copper statue of Pepi I*, <http://www.ancient-egypt.org/history/old-kingdom/6th-dynasty/pepi-i/statuette-of-pepi-i/small-copper-statuette-of-pepi-i.html>, 2014
 35. *World History*, *Royal sculpture*, <http://www.worldhistory.biz/ancient-history/63071-5-royal-sculpture.html>
 36. *Brooklyn Museum*, *Kneeling statuette of Pepi I*, <https://www.brooklynmuseum.org/opencollection/objects/73448>
 37. *Venica Clay Artists*, *Ancient Egyptian Art*, <http://www.venicelclayartists.com/ancient-egyptian-art-and-pottery/>
 38. *Virtual Egyptian Museum*, *Bronze of King Seti I, Dynasty 19*, <https://www.virtual-egyptian-museum.org/Collection/FullVisit/Collection.FullVisit-JFR.html?Content/MET.LL.00853.html&0>, 2004.
 39. *Virtual Egyptian Museum*, *Imhotep, Vizier and Architect of King Djoser*, <https://www.virtual-egyptian-museum.org/Collection/FullVisit/Collection.FullVisit-JFR.html?Content/MET.LL.00106.html&0>, 2004.
 40. F. Fardusun, *Kneeling bronze statue of Necho II, Late Period*, <https://www.pinterest.com/pin/432978951658872645/>
 41. *Metropolitan Museum*, *Kneeling statuette of King Amasis*, <https://www.pinterest.com/pin/148900331400512725/>
 42. *Venice Clay Artists*, *Bronze statuette of a woman, Late Period*, <http://www.venicelclayartists.com/ancient-egyptian-art-and-pottery/>
 43. D. Klemm, R. Klemm and A. Murr, *Gold of the Pharaohs: 6000 years of gold mining in egypt and Nubia*, *African Earth Sciences*, vol.33, pp.643-659, 2001.
 44. G. Herren, *Golden statuettes of King Tutankhamun*, <https://www.pinterest.com/pin/211458144982646406/>
 45. *R. Seaman*, *Statues of Tutankhamun*, <http://www.richard-seaman.com/Travel/Egypt/Cairo/Museum/Tutankhamun/Statues/>
 46. *Dream Stima*, *Golden statue of Queen Tuya*, <https://www.dreamstime.com/editorial-stock-photo-queen-tuya-golden-statuette-egyptian-museum-cairo-egypt>

[was-wife-pharaoh-seti-i-mother-tia-ramesses-image65149788](#)

47. Metropolitan Museum, Statue of Amun, <http://www.metmuseum.org/toah/works-of-art/26.7.1412/>
48. H. Caner, Silver statue of a Royal woman, <https://www.pinterest.com/pin/343540277803983515/>
49. British Museum, Gold-plated silver figure of Amun-Ra, http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=154939&partId=1

- Scholars interested in the authors publications can visit:

<http://scholar.cu.edu.eg/galal>

BIOGRAPHY



Galal Ali Hassaan

- Emeritus Professor of System Dynamics and Automatic Control.
- Has got his B.Sc. and M.Sc. from Cairo University in 1970 and 1974.
- Has got his Ph.D. in 1979 from Bradford University, UK under the supervision of Late Prof. John Parnaby.
- Now with the Faculty of Engineering, Cairo University, EGYPT.
- Research on Automatic Control, Mechanical Vibrations , Mechanism Synthesis and History of Mechanical Engineering.
- Published more than 200 research papers in international journals and conferences.
- Author of books on Experimental Systems Control, Experimental Vibrations and Evolution of Mechanical Engineering.
- Chief Justice of the International Journal of Computer Techniques.
- Member of the Editorial Board of some international journals including IJET.
- Reviewer in some international journals.